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| 6.2.3.2.3 | | |
| Verify the following secondary power supply voltages on the CRT are not flashing: | | |
| CG 1211 OPTX 28V 800 CPS 1 pct 0 ph | | |
| CG 1212 OPTX 800 CPS 5 pct-90 ph | | |
| 6.2.3.2.3.1 | | |
| Set/verify OPTICS MODE on the G&N Indicator Control Panel to MAN. | | |
| 6.2.3.2.3.2 | | |
| Set the OPTICS MODE on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. | | |
| 6.2.3.3 | | |
| IMU Cage Test | | |
| 6.2.3.3.1 | | |
| Enter the following into the DSKY: | | |
| a. VERB 40 NOUN 20, ENTER (wait 3 seconds) | | |
| b. VERB 41 NOUN 20, ENTER | | |
| c. +00200, ENTER | | |
| d. +00200, ENTER | | |
| e. +00200, ENTER | | |
| Observe that the NO ATT lamps on the DSKY's light and that CDUX, CDUY, CDUZ on the CRT indicate approximately +00200. | | |
| 6.2.3.3.2 | | |
| Set up the Analog Recorder to monitor the following signals: | | |
| a. IG 1X Resolver Output Sine (CG 2112) | | |
| b. MG 1X Resolver Output Sine (CG 2142) | | |
| c. OG 1X Resolver Output Sine (CG 2172) | | |
| Start the Analog Recorders. | | |
| 6.2.3.3.3 | | |
| On MDC panel 1, press and hold the IMU CAGE switch in the CAGE position. On the Analog Recorder, verify that the 1X Sine signals (CG 2112, CG 2142, and CG 2172) null out at 0.5V rms or less. | | |
| 6.2.3.3.4 | | |
| Release the IMU CAGE switch. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Sustained oscillations shall be cause for immediate removal of IMU OPERATE power. | | |
| 6.2.3.3.5 | | |
| On the CRT verify that CDUX, CDUY and CDUZ are all between +00150 and +35850. | | |
| 6.2.3.3.6 | | |
| Stop the Analog Recorders. | | |
| 6.2.4 | | |
| G&N System Power Supplies Test | | |

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- 6.2.4.1 Proceed with this test if 6.2.3, Operate Power On Test, has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding with this test. Insure that the IMU Operate Power has been on for at least 15 minutes before proceeding with this test.
- 6.2.4.2 Enter the following sequence into the K-Start. Verb 41 NOUN 20, ENTER; +00000 ENTER; +00000 ENTER; +00000 ENTER.
- 6.2.4.3 Set/Verify the following circuit breakers and switches on the Right Hand Circuit Breakers Panel and LEB.
- COMPUTER MN A to ON (pushed in) and COMPUTER MN B to OFF (pulled out).
 - G/N - POWER to AC1
 - IMU HTR MN A to ON (pushed in) and IMU HTR MN B to OFF (pulled out).
 - IMU MN A to ON (pushed in) and IMU MN B to OFF (pulled out).
 - G/N POWER - IMU to IMU
 - OPTICS MN A to ON (pushed in) and OPTICS MN B to OFF (pulled out).
 - G/N POWER - OPTICS to OPTICS
- 6.2.4.4 Record the voltage indicated on the CRT for the following signals:
- The +28 VDC IMU OPERATE (Buss No. 1) output voltage shall be $+28.8 \pm 3$ VDC (CG 1500).
 - The +28 VDC IMU STANDBY (Buss No. 2) output voltage shall be $+28.8 \pm 3$ VDC (CG 1510).
 - The +28 VDC CMC OPERATE (Buss No. 3) output voltage shall be $+28.8 \pm 3$ VDC (CG 1520).
 - The +28 VDC OPTX OPERATE (Buss No. 4) output voltage shall be $+28.8 \pm 3$ VDC (CG 1530).
 - The CG 2221, IGA CDU Coarse Error measurement shall be 0.0 ± 0.68 Vrms.
 - The CG 2251 MGA CDU Coarse Error measurement shall be 0.0 ± 0.68 Vrms.
 - The CG 2281 OGA CDU Coarse Error measurement shall be 0.0 ± 0.68 Vrms.
- 6.2.4.5 Record the voltage indicated on the CRT for the following power supplies:
- The +120 VDC PIPA Power Supply output voltage shall be 120 ± 6 VDC (CG 1040).
 - The +20 VDC PIPA Power Supply output voltage shall be 20.0 ± 1.2 VDC (CG 1051).
 - The -20 VDC PIPA Power Supply output voltage shall be -20 ± 2 VDC (CG 1052).
 - The -28 VDC Electronics Power Supply output voltage shall be -28.5 ± 6.0 VDC (CG 1100).

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| 6.2.4.6 | | |
| The following values shall be measured with the guidance reference clock synchronizing input pulse. Record the voltage indicated on the CRT. | | |
| a. IMU 28V, 800 CPS 1% 0 deg voltage shall be 28.0±0.6 VAC (CG 1201) | | |
| b. IMU 28V, 800 CPS, 5% PHA - 90 deg. voltage shall be 28.0±1.4 VAC (CG 1202). | | |
| c. IMU 28V, 800 CPS, 5% PHB 0 deg. voltage shall be 28.0±2.1 VAC (CG 1203). | | |
| d. Optics 28V, 800 CPS 1% 0 deg voltage shall be 28.0±0.6 VAC (CG 1211). | | |
| e. Optics 28V, 800 CPS 5% -90 deg voltage shall be 28.0±1.5 VAC (CG 1212). | | |
| f. PH Diff IMU 5% 0 deg. -90 deg. (CG 1207) phase difference shall be -90° ±10°. | | |
| g. PH Diff Optics 1% IMU 1% (CG 1220) phase difference shall be 0° ±10°. | | |
| 6.2.4.7 | | |
| Record the voltages indicated on the CRT for the following power supplies: | | |
| a. The +14 VDC CMC Power Supply output voltage shall be +14.0±0.4 VDC (CG 1020). | | |
| b. The +4 VDC CMC Power Supply output voltage shall be +4.0±0.2 VDC (CG 1030). | | |
| c. The +4 VDC CDU Power Supply output voltage shall be +4.0±0.2 VDC (CG 1070). | | |
| d. The +2.50 VDC TM BIAS SUPPLY output voltage shall be +2.50±0.05 VDC (CG 1110). | | |
| 6.2.4.8 | | |
| Record the CRT indications for the following measurements: | | |
| a. The 28V, 3200 CPS Power Supply feedback output voltage shall be 28.6±0.6V RMS (CG 1331). | | |
| b. The phase difference between the 3.2 Kc supply and CMC sync shall be 0° ±10° (CG 1336). | | |
| c. The +14 VDC CMC Power Supply RMS noise shall be less than 0.4 volts p-p (CG 1021). | | |
| d. The +4 VDC CMC Power Supply noise peaks shall be less than 0.4 volts p-p (CG 1031). | | |
| 6.2.4.9 | | |
| Set/Verify the following circuit breakers and switches on the Right Hand Circuit Breaker Panel and LEB: | | |
| a. G/N POWER-OPTICS to OFF | | |
| b. OPTICS MN B to ON (pushed in) and OPTICS MN A to OFF (pulled out) | | |
| c. G/N POWER - IMU to OFF | | |
| d. IMU MN B to ON (pushed in) and IMU MN A to OFF (pulled out). | | |
| e. IMU HTR MN A to OFF (pulled out) | | |
| f. G/N - POWER to OFF | | |
| g. COMPUTER MN B to ON (pushed in) and COMPUTER MN A to OFF (pulled out) | | |

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- 6.2.4.10 Verify that the +28 VDC CMC OPERATE output voltage is $\pm 28.8 \pm 3$ VDC (CG 1520).
- 6.2.4.11 Set the G/N - POWER switch on the LEB to AC2. Set the IMU HTR MN B to ON (pushed in). Verify that the +28 VDC IMU STANDBY output voltage is $\pm 28.8 \pm 3$ VDC (CG 1500).
- 6.2.4.12 Wait until 15 minutes have elapsed since setting G/N POWER - IMU to OFF in 6.2.4.9.c then set the G/N POWER - IMU to IMU. Verify that the +28 VDC IMU OPERATE output voltage is $\pm 28.8 \pm 3$ VDC (CG 1500).
- 6.2.4.13 Set the G/N POWER - OPTICS to OPTICS. Verify that the +28 VDC OPTX OPERATE output voltage is $\pm 28.8 \pm 3$ VDC (CG 1530).
- 6.2.4.14 Repeat 6.2.4.5 through 6.2.4.8.
- 6.2.4.15 Set the following circuit breakers to the position indicated:
- Set the COMPUTER MN A to ON (pushed in).
 - Set the IMU HTR MN A to ON (pushed in).
 - Set the IMU MN A to ON (pushed in).
 - Set the OPTICS MN A to ON (pushed in).
- 6.2.4.16 Miscellaneous Checks - The following miscellaneous signals are required to supply data for system evaluation in the event of failure, or for trend analysis of system performance. Record the values displayed on the CRT for the following signals.
- CG 4300 CMC Temperature
 - CG 6020 PIPA Calibration Module Temperature
 - CG 6021 IMU 800 CPS 5% Temperature
- 6.2.4.17 Verify and record the following signals displayed on the CRT:
- +120 VDC PIPA SUP NOISE RMS shall be less than 1.5 VRMS (CG 1042).
 - +20 VDC PIPA SUP NOISE RMS shall be less than 1.0 VRMS (CG 1053)
 - +4 VDC CDU SUP NOISE RMS shall be less than 1.0 VRMS (CG 1071).
 - +28V IMU OPERATE BUS NOISE RMS shall be less than 1.0 VRMS (CG 1601)
 - +28V IMU STANDBY BUS NOISE RMS shall be less than 1.0 VRMS (CG 1511).
 - +28V CMC OPERATE BUS NOISE RMS shall be less than 2.0 VRMS (CG 1521)
 - +28V OPTX OPERATE BUS NOISE RMS shall be less than 2.0 VRMS (CG 1531).
- 6.2.4.18 The noise peaks of the following signals are demonstrated on the event light when the peaks have a rise time between 2 and 50 usec and the peak voltage exceeds 5 volts.

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| a. | +14V CMC SUPPLY NOISE PEAKS | (CG 1022) |
| b. | +4V CMC SUPPLY NOISE PEAKS | (CG 1032) |
| c. | +120 VDC PIPA SUPPLY NOISE PEAKS | (CG 1043) |
| d. | +4 VDC CDU SUPPLY NOISE PEAKS | (CG 1072) |
| e. | +28V IMU OPERATE BUS NOISE PEAKS | (CG 1502) |
| f. | +28V IMU STANDBY BUS NOISE PEAKS | (CG 1512) |
| g. | +28V CMC OPERATE NOISE PEAKS | (CG 1522) |
| h. | +28V OPTX OPERATE NOISE PEAKS | (CG 1532) |
| 6.2.4.19 | If Optics Testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF. | |
| 6.2.5 | <u>General Turn Off and Turn On Procedure</u> | |
| | NOTE: The procedure shall be utilized any time after performing 6.2.1, Standby Power On Test and 6.2.3, Operate Power On Test to turn on or turn off the G&N Systems. Appropriate portions of this procedure will be referenced in other tests. | |
| 6.2.5.1 | Turn Off Procedure. | |
| | CAUTION: This procedure must be performed in the sequence specified. Failure to adhere to this sequence may require calibration of the inertial components. | |
| 6.2.5.1.1 | Enter the following sequence into the K-148. | |
| | a. VERB 41 NOUN 20, ENTER | |
| | b. +00000 ENTR | |
| | c. +00000 ENTR | |
| | d. +09000 ENTR | |
| | Verify that the GIMBAL LOCK indicator on the DSKY's is illuminated. | |
| 6.2.5.1.2 | Set the following switches on the G&N Indicator Control Panel to the positions designated. | |
| | a. OPTICS MODE to MANUAL | |
| | b. CONTROLLER MODE to DIRECT | |
| | c. CONTROLLER SPEED to LO | |
| | d. TELESCOPE TRUNNION to SLAVE TO SXT | |
| | e. RETICLE BRIGHTNESS to minimum brightness position | |
| 6.2.5.1.3 | Set the G/N Power - IMU switch on the LEB Lighting Control Panel to OFF and G&N IMU MN A and MN B circuit breakers on the Right Hand Circuit Breaker panel to OFF (breakers pulled out). | |

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| 6.2.5.1.4 | | |
| Decrease the LIGHTS - NUMERICS controls on both the Left Hand Circuit Breaker panel and the LEB Lighting Control Panel to the minimum brightness - OFF position. | | |
| 6.2.5.1.5 | | |
| Set the PSAAM power switch on the PSAAM to OFF. | | |
| 6.2.5.1.6 | | |
| Set the IMU HTR MN A and MN B circuit breaker on the Right Hand Circuit Breaker panel to OFF (breakers pulled out). | | |
| 6.2.5.1.7 | | |
| Set the G/N POWER - OPTICS switch on the LEB Lighting Control Panel to OFF and G&N OPTICS MN A and MN B breakers on the Right Hand Circuit breaker panel to OFF. | | |
| 6.2.5.1.8 | | |
| Set the COMPUTER MN A and MN B Circuit breakers on the Right Hand Circuit Breaker panel to OFF (breakers pulled out). | | |
| 6.2.5.1.9 | | |
| Set the G&N Power AC1-OFF-AC2 Switch on the Right Hand Circuit breaker panel to OFF and the G&N POWER AC1 and AC2 circuit breakers to OFF (breakers pulled out). | | |
| 6.2.5.1.10 | | |
| Verify that the PTC is supplying inertial components heater power to the G&N System. This will be indicated by the following on the PTC. | | |
| a. G&N ON (PTC inhibit) light not illuminated. | | |
| b. IMU Temp/heater current meter indicates IMU temperature of 130° ±5°F. | | |
| 6.2.5.2 | | |
| Turn ON Procedure | | |
| 6.2.5.2.1 | | |
| Set or verify the following G&N Indicator Control Panel switches to the position indicated. | | |
| a. CONDITION LAMPS to ON | | |
| b. OPTICS MODE to MANUAL | | |
| c. CONTROLLER COUPLING to DIRECT | | |
| d. CONTROLLER SPEED to LO | | |
| e. TELESCOPE TRUNNION to SLAVE to SXT | | |
| f. RETICLE BRIGHTNESS to minimum brightness position. | | |
| 6.2.5.2.2 | | |
| Insure that interfacing system EPS and ECS are turned on and operating properly. | | |
| CAUTION: The remaining procedure must be followed in sequence specified. Failure to adhere to this sequence may require recalibration of the inertial components. | | |

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| 6.2.5.2.3 | Energize the G&N COMPUTER MN A and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Press the STBY pushbutton on the DSKY for approximately 3 seconds. Verify +14 and +4 VDC AGC power supply outputs on CRT display. Voltages shall be +14±0.4V (CG1020) and +4±0.2 (CG1030). NOTE: Restart lamp may illuminate; if it does, disregard and press RSET on the DSKY. | | | | | |
| 6.2.5.2.4 | Energize the G&N IMU HTR, MN A and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Insure that the CMC +28 VDC discrete lamp on the Event Module is illuminated (CG 1523). | | | | | |
| 6.2.5.2.5 | Set the G&N POWER AC1 and AC2 breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in). Set the G&N POWER AC1-OFF-AC2 switch to AC1. | | | | | |
| 6.2.5.2.5.1 | Set the G&N DSKY and Display Panel brightness to the minimum acceptable level by manipulation of LIGHTS - NUMERICS control on both Left Hand Circuit breaker panel and LEB Lighting Control panel. | | | | | |
| 6.2.5.2.5.2 | Set/Verify the following switches on the PSAAM. | | | | | |
| | a. PSAAM Power to On | | | | | |
| | b. INHIBIT VOLTAGE FAIL to OFF. | | | | | |
| 6.2.5.2.6 | Disregard all alarm indications on the CMC DSKY panels. Enter VERB 36 into K148. Press ENTER pushbutton. Press ERROR RESET pushbutton on K148. All computer alarms except the Gimbal Lock Indicator on the Main Display Console (MDC) and LEB AGC DSKY shall clear. Verify registers R1, R2, and R3 on the DSKY's are cleared. | | | | | |
| 6.2.5.2.7 | Clear the CMC erasable memory by entering the following sequence into the K-Start. | | | | | |
| | a. VERB 92, press ENTER | | | | | |
| | b. 00015, press ENTER | | | | | |
| 6.2.5.2.8 | Initiate CMC self-check by entering the following sequence into the K-Start: | | | | | |
| | a. VERB 21 NOUN 27, ENTER | | | | | |
| | b. 77777, ENTER | | | | | |
| | c. VERB 05 NOUN 01, ENTER | | | | | |
| | d. 1366, ENTER | | | | | |
| 6.2.5.2.8.1 | Monitor DSKY until R3 (SCOUNT +2) increment twice. If an error is detected, the PROGRAM ALARM lamp on the DSKY's shall light. | | | | | |

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6.2.5.2.8.2 Enter the following into the K-Start:

- a. VERB 21
- b. NOUN 27 ENTER
- c. 00000, ENTER

NOTE: Allow 2 hours to elapse before proceeding to 6.2.5.2.9 with the following exceptions:

- a. If the G&N System has been in the power off state for less than 5 days with the gimbals in the parked position (0°, 0', 90°) and the system has not been moved, allow 15 minutes to elapse before proceeding.
- b. If the G&N System has been turned off with the gimbals in the unparked position for less than 2 hours allow a warmup time equal to the time off but not less than 15 minutes to elapse before proceeding.

CAUTION: If the requirements of 6.2.5.2.10 are not met, remove IMU Operate Power immediately by setting the G/N POWER-IMU switch on the LEB Lighting Control Panel to OFF.

6.2.5.2.9 After the required warmup time has elapsed set the G&N IMU MN A and MN B circuit breaker on the Right Hand circuit breaker panel to ON (breaker pushed in), and the G/N POWER - IMU switch on the LEB Lighting Control panel to the IMU position (toggle up).

6.2.5.2.10 Immediately begin monitoring the following measurements:

- a. On the CRT verify that IMU Operate Power is $+28.8 \pm 3$ VDC (CG 1500).
- b. On the meter modules verify that oscillations are not sustained and that a null is achieved within 10 seconds of power application on the following measurements:

| | |
|---------|---------------------------|
| CG 2112 | IG 1X Resolver Output Sin |
| CG 2142 | MG 1X Resolver Output Sin |
| CG 2172 | OG 1X Resolver Output Sin |

- c. On the CRT verify the absence of the +120 VDC PIPA Supply (CG 1040) for a period of 90 ± 10 seconds following power application. After approximately 100 seconds, the voltage shall read $+120 \pm 6$ VDC.

6.2.5.2.11 Verify that the PROGRAM ALARM lamp on the DSKY's does not light.

6.2.5.2.12 Enter and verify VERB 40, NOUN 20 into K148. Press the ENTER pushbutton.

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- 6.2.5.2.13 Enter and verify VERB 41, NOUN 20 into K148. Press the ENTER pushbutton to advance the System to the Coarse Align mode. The VERB-NOUN display on the CRT shall flash and indicate 21-22.
- 6.2.5.2.14 Enter and verify +00000 into K148 three times, pressing the ENTER pushbutton on the K-START after each entry.
- 6.2.5.2.15 Set the G&N OPTICS MN A and MN B circuit breakers on the Right Hand Circuit breaker panel to the ON position (breaker pushed in).

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6.2.5.2.16 Verify that the CRT indications of the signals in Table VI are not flashing.

Table VI. Secondary Power Supply Voltages

| Measurement Number | Signal |
|--------------------|----------------------------|
| 1 CG 1040 | +120 VDC PIPA SUPPLY |
| 2 CG 1051 | +20 VDC PIPA SUPPLY |
| 3 CG 1052 | -20 VDC PIPA SUPPLY |
| 4 CG 1070 | +4 VDC CDU SUPPLY |
| 5 CG 1100 | -28 VDC ELECTRONICS |
| 6 CG 1020 | +14 VDC CMC SUPPLY |
| 7 CG 1030 | +4 VDC CMC SUPPLY |
| 8 CG 1201 | DMU 28V 800 CPS 1 pct 0 ph |
| 9 CG 1202 | DMU 28V 800 CPS 5 pct ph A |
| 10 CG 1203 | DMU 28V 800 CPS 5 pct ph B |
| 11 CG 1331 | 3.2 KC 28V SUPPLY |
| 12 CG 1110 | 2.5 VDC TM WIAS |
| 13 CG 2300 | PIPA TEMPERATURE |
| 14 CG 2301 | IRIG TEMPERATURE |

6.2.5.2.17 Monitor the PIPA Display Scope to insure that each PIPA is moding properly.

6.2.5.2.18 Perform 6.2.6 G&N Operational Test.

6.2.5.3 Master Initialization

6.2.5.3.1 Set/verify the following Circuit Breakers and switches.

- G&N COMPUTER MNA & MNB
- G&N POWER AC1 & AC2
- G&N DMU HTR MNA & MNB
- G/W POWER AC1 - OFF - AC2 switch to AC1

NOTE: If DMU OPERATE POWER is not ON proceed to 6.2.5.2.9.

6.2.5.3.2 Verify that the PIPA Temperature (CG 2300) is $130.0 \pm 1.5^{\circ}\text{F}$.

NOTE: If the GIMBAL LOCK lamp on the DSKY is lit, proceed to 6.2.5.3.5.

6.2.5.3.3 Enter VERB 36, ENTER into K148.

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6.2.5.3.4 Enter VERB 40 NOUN 20, ENTER into K148.

6.2.5.3.5 Enter the following into K148.

- a. VERB 41 NOUN 20, ENTER
- b. +00000, ENTER
- c. +00000, ENTER
- d. +00000, ENTER

Observe the NO ATT lamp lights and the Inner, Outer, and Middle Gimbal Angles are $0 \pm 1.5^\circ$ as indicated by CDU X, CDU Y, and CDU Z on the CRT.

6.2.5.3.6 Press the ERROR RESET pushbutton. Enter the following into K148.

- a. VERB 92, ENTER
- b. 00015, ENTER

6.2.6 G&N Operation Test

6.2.6.1 Initial Conditions

6.2.6.1.1 Perform Master Initialization 6.2.5.3 before proceeding.

6.2.6.1.2 Enter the following into K148.

- a. VERB 01 NOUN 10, ENTER
- b. 00003, ENTER

Record R1 = AAAAA and Range Time.

6.2.6.1.3 Enter the following into K148.

- a. VERB 21 NOUN 02, ENTER
- b. 01300, ENTER
- c. AAAAA, ENTER
- d. VERB 06 NOUN 02, ENTER
- e. 01300, ENTER

Record R1 = BBBBB

6.2.6.1.4 Perform the following calculations:

- a. $\frac{(BBBBB) \times 5.12}{3600} = CC.C$ (hours in high order scalar channel 3)
- b. $23.3 - CC.C = DD.D$ hours
- c. DD.D plus the time of day recorded in 6.2.6.1.2 = the time at which the high order scalar, channel 3, will overflow.

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Do not enter the G&N Operational Test within 12 minutes of the time calculated in 6.2.6.1.4.c. If the test is in process at this time, undesirable results will occur.

6.2.6.2 Test Initiation

6.2.6.2.1 Enter VERB 92 into K148. Press the ENTER pushbutton.

6.2.6.2.2 Enter 00004 into K148. Press the ENTER pushbutton.

6.2.6.2.3 Observe VERB 16 NOUN 10 displayed on CRT. The NO ATT discrete shall appear momentarily then go OFF. Verify that the PROGRAM display on the CRT indicates 07.

NOTE: During this portion of the test the G&N System is exercised through its modes. Any failure will be indicated by the PROGRAM ALARM lamp on the DSKY's lighting.

6.2.6.2.4 After approximately 12 minutes, VERB 06, NOUN 66 will flash and the value of the gravity vector in cm/sec^2 shall be displayed in R1 and R2 on the CRT. Record these values.

6.2.6.2.5 R1 contains the first five digits of the gravity vector and R2 contains the last five digits. A decimal point shall be between them. The value for the gravity vector shall be $980.00000 \pm 05.00000 \text{ cm/sec}^2$.

6.2.6.2.6 Enter VERB 33 into K148. Press the ENTER pushbutton.

6.2.6.2.7 When VERB 06 NOUN 98 flashes the value of the horizontal earth rate shall be displayed in R1 and R2 on the CRT. Record these values.

6.2.6.2.8 R1 contains the first five digits of earth rate and R2 contains the last five digits. A decimal point shall be placed between them. R1 shall always be 00000. The horizontal earth rate shall be 00000.88000 ± 0.1000 earth rate units.

6.2.6.3 Test Termination

6.2.6.3.1 Enter VERB 36 into K148. Press the ENTER pushbutton.

6.2.6.3.2 Enter VERB 41, NOUN 20 into K148. Press the ENTER pushbutton.

6.2.6.3.3 Enter +00000 into K148 three times. Press the ENTER pushbutton after each entry.

6.2.7 Gimbal Friction Test

6.2.7.1 Perform Master Initialization, 6.2.5.3, before proceeding.

| | | |
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6.2.7.1.1 Enter the following into the K-START:

VERB 41 NOUN 20 ENTER
+17000 ENTER
+17000 ENTER
+17000 ENTER

6.2.7.1.2 Verify on the CRT that R1 = +17000, R2 = +17000 and R3 = +17000. Wait 15 seconds and enter the following into the K-START:

VERB 41 NOUN 20 ENTER
+27000 ENTER
+27000 ENTER
+27000 ENTER

6.2.7.1.3 Verify on the CRT that R1 = +27000, R2 = 27000 and R3 = 27000. Wait 15 seconds and enter the following:

VERB 41 NOUN 20 ENTER
+00000 ENTER
+00000 ENTER
+00000 ENTER

6.2.7.1.4 Verify on the CRT that R1 = +00000, R2 = +00000 and R3 = +00000. Wait 15 seconds before proceeding.

6.2.7.2 Inner Gimbal Friction Test

6.2.7.2.1 Setup the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):

a. CG 2120 IG TORQUE MOTOR CURRENT
b. CG 2117 IGA SERVO ERROR IN PHASE
c. CG 2112 IG 1X RESOLVER OUTPUT SIN
d. CG 2113 IG 1X RESOLVER OUTPUT COS
e. CG 2220 IGA CDU FINE ERROR
f. CG 2221 IGA CDU Coarse Error

6.2.7.2.2 Enter the following sequence into the K-Start, pushing the ENTER pushbutton after each entry (+360 IG torquing).

a. VERB 24 NOUN 01, ENTER
b. 00407, ENTER
c. 40000, ENTER
d. 40034, ENTER

Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.

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- 6.2.7.2.3 Enter the following sequence into K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (verify VERB 33 on CRT)
- 6.2.7.2.4 Start analog recorders.
- 6.2.7.2.5 Verify that IG Servo Error Quadrature (CG 2108) is 0.0 ± 1.2 Vrms. Observe measurement CG 2112, IG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders. During this period monitor IG TORQUE MOTOR CURRENT (CG 2120) on the CRT.
- 6.2.7.2.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- VERB 40, NOUN 20, press ENTER
 - VERB 41, NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
- 6.2.7.2.7 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.2.8 Enter the following sequence into the K-Start. Push the ENTER push button after each entry (-360° IG torquing):
- VERB 24 NOUN 01 ENTER
 - 00407, ENTER
 - 37777, ENTER
 - 37743, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.2.9 Enter the following sequence into K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (verify VERB 33 on CRT).
- 6.2.7.2.10 Start analog recorders.
- 6.2.7.2.11 Observe measurement CG 2112, IG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.

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- 6.2.7.2.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- VERB 40, NOUN 20, press ENTER
 - VERB 41, NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
- 6.2.7.2.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.3 Outer Gimbal Friction Test.
- 6.2.7.3.1 Setup the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):
- CG 2180 OG TORQUE MOTOR CURRENT
 - CG 2177 OGA SERVO ERROR IN PHASE
 - CG 2172 OG 1X RESOLVER OUTPUT SIN
 - CG 2173 OG 1X RESOLVER OUTPUT COS
 - CG 2280 OGA CDU FINE ERROR
 - CG 2281 OGA CDU Coarse Error
- 6.2.7.3.2 Enter the following sequence into the K-Start. Pushing the ENTER push-button after each entry (+360° OG torquing):
- VERB 24 NOUN 01, ENTER
 - 00405, ENTER
 - 40000, ENTER
 - 40034, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.3.3 Enter the following sequence into K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (verify VERB 33 on CRT)
- 6.2.7.3.4 Start analog recorders
- 6.2.7.3.5 Observe measurement CG 2172, OG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders. During this period monitor OG TORQUE MOTOR CURRENT (CG 2180) on the CRT.

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- 6.2.7.3.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- a. VERB 40, NOUN 20, press ENTER
 - b. VERB 41, NOUN 20, press ENTER
 - c. +00000, press ENTER
 - d. +00000, press ENTER
 - e. +00000, press ENTER
- 6.2.7.3.7 Verify that OG Servo Error Quadrature (CG 2168) is 0.0 ± 1.2 Vrms. Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 29 seconds before proceeding.
- 6.2.7.3.8 Enter the following sequence into the K-Start. Push the ENTER pushbutton after each entry (-360° OG torquing):
- a. VERB 24 NOUN 01, ENTER
 - b. 00405, ENTER
 - c. 37777, ENTER
 - d. 37743, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.3.9 Enter the following sequence into K-Start:
- a. VERB 42, press ENTER
 - b. VERB 33, press ENTER (verify VERB 33 on CRT)
- 6.2.7.3.10 Start analog recorders.
- 6.2.7.3.11 Observe measurement CG 2172, OG 1X resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorder.
- 6.2.7.3.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start:
- a. VERB 40, NOUN 20, press ENTER
 - b. VERB 41, NOUN 20, press ENTER
 - c. +00000, press ENTER
 - d. +00000, press ENTER
 - e. -06750, press ENTER
- 6.2.7.3.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = -06750. Wait 30 seconds before proceeding.

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| 6.2.7.4 | Middle Gimbal Friction Test. | | | | | | |
| 6.2.7.4.1 | Setup the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec): | | | | | | |
| | a. CG 2150 | MG TORQUE MOTOR CURRENT | | | | | |
| | b. CG 2147 | MGA SERVO ERROR IN PHASE | | | | | |
| | c. CG 2142 | MG 1X RESOLVER OUTPUT SIN | | | | | |
| | d. CG 2143 | MG 1X RESOLVER OUTPUT COS | | | | | |
| | e. CG 2250 | MGA CDU FINE ERROR | | | | | |
| | f. CG 2251 | MGA CDU Coarse Error | | | | | |
| 6.2.7.4.2 | Enter the following sequence into the K-Start. Push the ENTER pushbutton after each entry (+135° MG torquing): | | | | | | |
| | a. VERB 24, NOUN 01, ENTER | | | | | | |
| | b. 00411, ENTER | | | | | | |
| | c. 63777, ENTER | | | | | | |
| | d. 77777, ENTER | | | | | | |
| | Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3. | | | | | | |
| 6.2.7.4.3 | Enter the following sequence in the K-Start: | | | | | | |
| | a. VERB 42, press ENTER | | | | | | |
| | b. VERB 33, press ENTER (Verify VERB 33 on CRT) | | | | | | |
| 6.2.7.4.4 | Start the analog recorder. | | | | | | |
| 6.2.7.4.5 | Verify that MG Servo Error Quadrature (CG 2138) is 0.0 ± 1.2 Vrms. | | | | | | |
| 6.2.7.4.5 | Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs (approximately 5 minutes), stop the recorders. During this 5 minute period monitor MG TORQUE MOTOR CURRENT (CG 2150) on the CRT. | | | | | | |
| 6.2.7.4.6 | Return the G&N System to the coarse align mode by entering the following sequence in the K-Start. | | | | | | |
| | a. VERB 40 NOUN 20, ENTER | | | | | | |
| | b. VERB 41 NOUN 20, press ENTER | | | | | | |
| | c. +00000, press ENTER | | | | | | |
| | d. +00000, press ENTER | | | | | | |
| | e. +06750, press ENTER | | | | | | |

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- 6.2.7.4.7 Enter the following sequence into the K-Start. Push ENTER pushbutton after each entry (-135° MG torquing):
- a. VERB 24 NOUN 01, ENTER
 - b. 00411, ENTER
 - c. 14000, ENTER
 - d. 00000, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.4.8 Enter the following sequence in the K-Start:
- a. VERB 42, press ENTER
 - b. VERB 33, press ENTER (Verify VERB 33 on CRT)
- 6.2.7.4.9 Start analog recorders.
- 6.2.7.4.10 Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When the steady-state condition occurs (approximately 5 minutes), stop the recorders.
- 6.2.7.4.11 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- a. VERB 40 NOUN 20, press ENTER
 - b. VERB 41 NOUN 20, press ENTER
 - c. +00000, press ENTER
 - d. +00000, press ENTER
 - e. +00000, press ENTER
- 6.2.7.5 Examine the traces of the recorded measurements for all six phases of this test to detect any sharp discontinuities. Disregard transients of 0.5 second duration or less on the Gimbal Torque motor current traces, and those less than 0.2 second on the CDU fine error measurement traces. The Gimbal Torque motor currents shall not exceed 0.125 ampere. The CDU Fine Error measurements shall not exceed ±70 mv rms. The CDU Coarse Error measurement shall not exceed ±680 mv rms.

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- 6.2.8 G&N Panel Brightness and Lamp Test.
- 6.2.8.1 Proceed with this test if 6.2.5.2 or 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2 before proceeding with this test.
- 6.2.8.2 Rotate the RETICLE BRIGHTNESS thumbwheel on the Control Indicator Panel and verify the capability to control the illumination of the following lamps:
- a. SCT reticles
 - b. SXT reticles
 - c. Telescope Panel Angle Counters
- 6.2.8.3 Turn on LIGHTS-INTEGRAL control on Left Hand Circuit Breaker panel and LEB Lighting Control Panel.
- 6.2.8.4 Adjust the brightness controls on the LEB Lighting Control Panel and Left Hand Circuit Breaker Panel from minimum brightness to maximum brightness. Verify the operation of the G&N Indicator Control Panel lamps.
- 6.2.8.4.1 Re-adjust brightness controls for minimum acceptable lighting. Turn off LIGHTS-INTEGRAL control on Left Hand Circuit Breaker panel and LEB Lighting Control Panel.
- 6.2.8.5 Push and hold the CONDITION LAMPS switch on the G&N Indicator Control Panel to TEST. Verify the illumination of the following lamps:
- a. STAR ACQ
 - b. MASTER ALARM lamp
- 6.2.8.6 Set the CONDITION LAMPS switch to ON. Lamps a and b in 6.2.8.5. shall extinguish.

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| 6.2.9 | Semi-Automatic Moding Check |
| | Proceed with this test if 6.2.3 has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 before proceeding with this test. |
| 6.2.9.1 | Test Initiation |
| 6.2.9.1.1 | Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify OPTX BUS, 28V 800 ~ 1% and 5% Power Supplies. |
| 6.2.9.1.2 | Enter VERB 92 into KL48. Press the ENTER pushbutton. |
| 6.2.9.1.3 | Enter 00010 into KL48. Press the ENTER pushbutton. |
| 6.2.9.1.4 | Observe VERB 06 NOUN 01 flashes on the CRT and the PROGRAM display indicates 07. |
| 6.2.9.2 | Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall light. After approximately 30 seconds the following data shall be displayed on the CRT: |
| | a. VERB 06 NOUN 02 flashing |
| | b. R1 = +00000 ± 00007 |
| | c. R2 = +00000 ± 00007 |
| | d. R3 = +00000 ± 00007 |
| | e. IG angle = 000 ± 1 deg. |
| | f. MG angle = 000 ± 1 deg. |
| | g. OG angle = 000 ± 1 deg. |
| 6.2.9.3 | Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT: |
| | a. VERB 06 NOUN 03 flashing |
| | b. R1 = +04500 ± 00007 |
| | c. R2 = +04500 ± 00007 |
| | d. R3 = +04500 ± 00007 |
| | e. IG angle = 045 ± 1 deg. |
| | f. MG angle = 045 ± 1 deg. |
| | g. OG angle = 045 ± 1 deg. |
| 6.2.9.4 | Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 100 seconds the following data shall be displayed on the CRT: |
| | a. VERB 05 NOUN 97 flashing |
| | b. R1 = 00000 ± 00003 |
| | c. R2 = 00000 ± 00003 |
| | d. R3 = 00000 ± 00003 |
| | NOTE: Negative numbers will be displayed in octal complement form, i.e., -00001 = 77776. |

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| 6.2.9.5 | | |
| <p>Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS Caution lamp on the Indicator Control Panel shall light.</p> <p>a. VERB 06 NOUN 05 flashing</p> <p>b. R1 = +07100 ± 00007</p> <p>c. R2 = +07100 ± 00007</p> <p>d. R3 = +07100 ± 00007</p> <p>e. IG angle = 071 ± 1 deg.</p> <p>f. MG angle = 071 ± 1 deg.</p> <p>g. OG angle = 071 ± 1 deg.</p> <p>The GIMBAL LOCK lamps on the DSKY's shall light.</p> | | |
| 6.2.9.6 | | |
| <p>Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.</p> <p>a. VERB 06 NOUN 06 Flashing</p> <p>b. R1 = +09000 ± 00007</p> <p>c. R2 = +09000 ± 00007</p> <p>d. R3 = +09000 ± 00007</p> <p>e. IG angle = 090 ± 1 deg.</p> <p>f. MG angle = 090 ± 1 deg.</p> <p>g. OG angle = 090 ± 1 deg.</p> | | |
| 6.2.9.7 | | |
| <p>Enter VERB 33 and Press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.</p> <p>a. VERB 06 NOUN 07</p> <p>b. R1 = +13500 ± 00007</p> <p>c. R2 = +13500 ± 00007</p> <p>d. R3 = +13500 ± 00007</p> <p>e. IG angle = 135 ± 1 deg.</p> <p>f. MG angle = 135 ± 1 deg.</p> <p>g. OG angle = 135 ± 1 deg.</p> | | |
| 6.2.9.8 | | |
| <p>Enter VERB 33 and press ENTER. After approximately 20 seconds VERB 06 NOUN 10 shall flash. The GIMBAL LOCK lamp shall extinguish on the DSKY's. The PGNS Caution lamp on the Indicator Control Panel shall extinguish. The gimbal angles shall be approximately 135°, 135°, and 45° respectively.</p> | | |
| 6.2.9.9 | | |
| <p>Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 100 seconds the following data shall be displayed on the CRT.</p> <p>a. VERB 05 NOUN 30 flashing.</p> <p>b. R1 = 00000 ± 00003</p> <p>c. R2 = 00000 ± 00003</p> <p>d. R3 = 00000 ± 00003</p> | | |

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| 6.2.9.10 | Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS caution lamp on the Indicator Control Panel shall light. | | | | | | |
| | a. VERB 06 NOUN 12 flashing | | | | | | |
| | b. R1 = +22500±00007 | | | | | | |
| | c. R2 = +22500±00007 | | | | | | |
| | d. R3 = +22500±00007 | | | | | | |
| | e. IG angle = 225±1 deg. | | | | | | |
| | f. MG angle = 225±1 deg. | | | | | | |
| | g. OG angle = 225±1 deg. | | | | | | |
| | The GIMBAL LOCK lamp on the DSKY's shall light. | | | | | | |
| 6.2.9.11 | Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS caution lamp on the Indicator Control Panel shall extinguish. | | | | | | |
| | a. VERB 06 NOUN 13 flashing | | | | | | |
| | b. R1 = +22500±00007 | | | | | | |
| | c. R2 = +22500±00007 | | | | | | |
| | d. R3 = +31500±00007 | | | | | | |
| | e. IG angle = 225±1 deg. | | | | | | |
| | f. OG angle = 225±1 deg. | | | | | | |
| | g. MG angle = 315±1 deg. | | | | | | |
| | The GIMBAL LOCK lamp on the DSKY shall extinguish. | | | | | | |
| 6.2.9.12 | Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 100 seconds the following data shall be displayed on the CRT. | | | | | | |
| | a. VERB 05 NOUN 30 flashing | | | | | | |
| | b. R1 = 00000±00003 | | | | | | |
| | c. R2 = 00000±00003 | | | | | | |
| | d. R3 = 00000±00003 | | | | | | |
| 6.2.9.13 | Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. | | | | | | |
| | a. VERB 06 NOUN 15 flashing | | | | | | |
| | b. R1 = +31500±00007 | | | | | | |
| | c. R2 = +31500±00007 | | | | | | |
| | d. R3 = +31500±00007 | | | | | | |
| | e. IG angle = 315±1 deg. | | | | | | |
| | f. MG angle = 315±1 deg. | | | | | | |
| | g. OG angle = 315±1 deg. | | | | | | |

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| 6.2.9.14 | Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 100 seconds the following data shall be displayed on the CRT. a. VERB 05 NOUN 30 flashing b. R1 = 00000±00003 c. R2 = 00000±00003 d. R3 = 00000±00003 |
| 6.2.9.15 | Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS Caution lamp on the Indicator Control Panel shall light. a. VERB 06 NOUN 17 flashing b. R1 = +28900±00007 c. R2 = +28900±00007 d. R3 = +28900±00007 e. IG angle = 289±1 deg. f. OG angle = 289±1 deg. g. MG angle = 289±1 deg. The GIMBAL LOCK lamp on the DSKY's shall light. |
| 6.2.9.16 | Enter VERB 33 and press ENTER. After approximately 20 seconds the following data will be displayed on the CRT. The PGNS Caution lamp on the Indicator Control Panel shall extinguish. a. VERB 06 NOUN 20 flashing b. R1 = +00000±00007 c. R2 = +00000±00007 d. R3 = +00000±00007 e. IG angle = 000±1 deg. f. MG angle = 000±1 deg. g. OG angle = 000±1 deg. The GIMBAL LOCK lamp on the DSKY's shall extinguish. |
| 6.2.9.17 | Enter VERB 33 and press ENTER. The COMP ACTY lamp on the DSKY's shall flash for a few seconds. After approximately 15 seconds the following data shall be displayed on the CRT. a. VERB 06 NOUN 08 flashing b. R1 = 000xx c. R2 = xxxxx The GIMBAL LOCK lamp on the DSKY's shall light. The PGNS Caution lamp on the Indicator Control Panel shall light. Record R1 and R2 as the Middle Gimbal CDU drive rate. MG rate = $\frac{R1 \cdot R2}{\text{sec}}$. The Middle Gimbal CDU drive rate shall be 14±2°/sec. |

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- 6.2.9.18 Enter VERB 33 into K148. Press the ENTER pushbutton. After approximately 30 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 08 flashing
 - b. R1 = 000xx
 - c. R2 = xxxxx
- The GIMBAL LOCK lamp on the DSKY's shall extinguish. The PGNS Caution lamp on the Indicator Control Panel shall extinguish.
- Record R1 and R2 as the Inner Gimbal CDU drive rate.
IG rate = $\frac{R1}{R2}$ /sec. The Inner Gimbal CDU drive rate shall be 1442" /sec.
- 6.2.9.19 Enter VERB 33 into K148. Press the ENTER pushbutton. After approximately 30 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 08 flashing
 - b. R1 = 000xx
 - c. R2 = xxxxx
- Record R1 and R2 as the Outer Gimbal CDU drive rate.
OG rate = $\frac{R1}{R2}$ /sec. The Outer Gimbal CDU drive rate shall be 1442" /sec.
- 6.2.9.20 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall extinguish. After approximately 20 seconds VERB 21 NOUN 22 shall flash on the CRT. Enter +00100 into K148 three times. Press the ENTER pushbutton after each entry. The NO ATT lamp on the DSKY's shall momentarily light, then extinguish. After approximately 100 seconds VERB 01 NOUN 10 flashing shall be displayed on the CRT. Press the ENTER pushbutton.
- Enter 00030 into K148. Press the ENTER pushbutton. Verify R1 = 33xxx.
- The ISS WARNING Lamp on the Indicator Control Panel shall light.
The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be ON.
- 6.2.9.21 Enter VERB 33 into K148. Press the ENTER pushbutton. ISS WARNING and ISS CDU FAIL shall be OFF. After approximately 20 seconds VERB 21 NOUN 22 shall flash on the CRT. Enter +03375 into K148 three times. Press the ENTER pushbutton after each entry. The NO ATT lamp on the DSKY's shall momentarily light, then extinguish. After approximately 100 seconds VERB 01 NOUN 10 flashing shall be displayed on the CRT. Press the ENTER pushbutton.
- Enter 00030 into K148. Press the ENTER pushbutton.
Verify R1 = 33xxx.
- The ISS WARNING lamp on the Indicator Control Panel shall light.
The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be ON.

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- 6.2.9.22 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds VERB 06 NOUN 91 shall flash on the CRT. The ISS WARNING lamp on the Control Indicator Panel shall extinguish. The ISS WARNING and ISS CDS FAIL discretes on the CRT shall be OFF.
- 6.2.9.23 Set the OPTICS MODE switch on the Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to CMC.
- 6.2.9.24 Enter VERB 33, press ENTER. After approximately 25 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98 flashing
 - b. R1 = 000xx
 - c. R2 = xxxxx
- Record R1 and R2 as the Shaft Optics CDU drive rate.
Shaft rate = $\frac{R1}{R2}$. The Shaft Optics CDU drive rate shall be 7.32 ± 1.82 /sec.
- 6.2.9.25 Enter VERB 33 into K148. Press the ENTER pushbutton. In about 15 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98
 - b. R1 = 0000x
 - c. R2 = xxxxx
- Record R1 and R2 as the Trunnion Optics CDU drive rate. Trunnion rate = $\frac{R1}{R2}$. The Trunnion Optics CDU drive rate shall be 1.83 ± 0.50 /sec.
- 6.2.9.26 Terminate the Semi-Automatic Moding Check by entering VERB 34 into K148. Observe PROG display on DSKY's is 00. Press the ENTER pushbutton. If Optics testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Panel to OFF.

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- 6.2.10 Zero Optics Test
- 6.2.10.1 Set the G&N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.
- NOTE: Proceed with this test if 6.2.3 Operate Power on Test has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 Turn On procedure before proceeding.
- 6.2.10.2 Insure that the following switches on the G&N Indicator Control Panel are set as follows:
- a. TELESCOPE TRUNNION to SLAVE to SXT
 - b. CONTROLLER COUPLING to DIRECT
 - c. CONTROLLER SPEED to HI
- 6.2.10.3 Monitor the Optics CDU's by entering VERB 16 NOUN 55 into K148. Press the ENTER pushbutton.
- 6.2.10.4 Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Verify the Optics have zeroed properly by observing the following on R1 and R2 of the CRT.
- a. R1 = $+0.00^{\circ} +0.02^{\circ}$, -0.03° (Shaft Angle)
 - b. R2 = $+0.000^{\circ} +0.006^{\circ}$, -0.007° (Trunnion Los Angle)
- Return the OPTICS MODE switch to MAN.
- 6.2.10.5 Set up the Analog Recorder to monitor the following measurements. Use a chart speed of 10 mm/sec.
- a. CG 3140 SXT Shaft Tach Output
 - b. CG 3150 SXT Trunnion Tach Output
 - c. CG 3160 SCT Shaft Tach Output
 - d. CG 3170 SCT Trunnion Tach Output
 - e. CG 3117 SXT Shaft Servo Error in phase
 - f. CG 3118 SXT Trunnion Servo Error in phase
 - g. CG 3145 SXT Shaft MTR control winding
 - h. CG 3155 SXT Trunnion MTR control winding
- 6.2.10.6 Push the Optics Hand Controller to the right, driving the SXT Shaft until R1 on the CRT indicates $+180 \pm 1^{\circ}$. Push the Optics Hand Controller up, driving the SXT Trunnion until R2 on the CRT indicates $+75 \pm 1^{\circ}$.
- 6.2.10.7 Start the Analog Recorders and set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO.

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| 6.2.10.8 | | |
| Monitor the Analog Recorders until all signals return to null. Stop the Analog Recorders. The elapsed time between the initial and final SXT Tach output null shall be less than 15 seconds. The peak magnitude of the SXT Shaft (CG 3140) and Trunnion (CG 3150) Tach Outputs shall be $-3.3 \pm 1.3V$ rms. The peak magnitude of the SCT Shaft Tach Output (CG 3160) shall be $+3.3 \pm 1.3V$ rms. The peaks magnitude of the SCT Trunnion Tach Output (CG 3170) shall be $0.85 \pm 0.35V$ rms. The SXT SHAFT (CG 3117) and TRUNNION (CG 3118) Servo Error In Phase measurements shall each have a maximum magnitude of 2 VRMS. The peak magnitude of the SXT SHAFT (CG 3145) and TRUNNION (CG 3155) MTR Control Winding measurements shall be 0.85 ± 0.35 VRMS. | | |
| 6.2.10.9 | | |
| Record R1 and R2 on the CRT. The data displayed shall be as follows: | | |
| a. R1 = 000.00 ± 000.03 | | |
| b. R2 = 00.000 ± 00.006 | | |
| 6.2.10.10 | | |
| Record the Telescope Panel Angle Counter indications. The Shaft Angle shall be 0.0 ± 0.11 degrees. The Trunnion Angle shall be 0.0 ± 0.22 degrees. | | |
| 6.2.10.11 | | |
| Set the OPTICS MODE switch on the G&N Indicator Control Panel to MAN. Set the G/N Power Optics switch on the LEB Lighting Control Panel to OFF. | | |
| 6.2.10.12 | | |
| Insert the universal tool or equivalent into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eyepiece while turning the tool until the TPAC reads $+5^\circ$. Remove the tool from the trunnion tool input. | | |
| 6.2.10.13 | | |
| Insert the Universal Tool or equivalent into the Shaft Tool input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to $+3^\circ$ to -3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool. | | |
| 6.2.10.14 | | |
| Insert the Universal Tool or equivalent into the Trunnion Tool input. Verify that the Trunnion Turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from $+5^\circ$ to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool. | | |
| 6.2.11 | | |
| OPTICS Coordinate Transformation Control Test | | |
| 6.2.11.1 | | |
| Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies. | | |
| NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding. | | |

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- 6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.
- TELESCOPE TRUNNION to SLAVE TO SXT
 - CONTROLLER COUPLING to DIRECT
 - CONTROLLER SPEED TO HI
- 6.2.11.3 Enter the following into the K-Start to monitor the OPTICS CDU's
- VERB 16 NOUN 91, press ENTER
- 6.2.11.4 Set the OPTICS MODE switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS MODE switch to MAN.
- 6.2.11.5 Set up the analog recorders to monitor the following measurements:
- CG 3160 SCT Shaft Tachometer Output
 - CG 3170 SCT Trunnion Tachometer Output
- 6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until R1 = +225.00 and R2 = +10.000 on the CRT and the DSKY's.
- 6.2.11.7 Set the CONTROLLER COUPLING switch on the G&N Panel to RSLV and the controller speed switch to MED.
- 6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern, then start the analog recorders at a chart speed of 10 mm/second.
- 6.2.11.9 Quickly displace the OPTICS CONTROL STICK 45±10 degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at 45±10 deg. When Target leaves the SCT upper right field of view press MARK pushbutton and immediately record the shaft angle as displayed on R1 of the DSKY. The recorded shaft angle shall be +225±10.00 degrees.
- 6.2.11.10 Stop the analog recorder and measure the elapsed time between the initial and the final signal null conditions for the two measurements. The elapsed time shall be from 24 to 36 seconds.
- 6.2.11.11 Set the CONTROLLER COUPLING switch on the G&N Panel to DIRECT. Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN.
- NOTE: If optics testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.

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6.2.12 OPTICS FUNCTIONAL TEST-VAB

6.2.12.1 Deleted.

6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:

a. +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8±3 VDC. Record the indication on the CRT.

b. CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.

c. CG 1212 OPTX 800 cps 5% - 90 ph not flashing on CRT.

6.2.12.3 Deleted.

6.2.12.4 Insure that the Optics control switches on the G&N Indicator Control Panel are set as follows:

a. OPTICS MODE to MAN

b. CONTROLLER SPEED to LO

c. CONTROLLER COUPLING to DIRECT

d. TELESCOPE TRUNNION to SLAVE to SXT

6.2.12.5 Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN.

6.2.12.6 Resolution Checks

6.2.12.6.1 Sight through the SCT EYEPIECE. Using the OPTICS CONTROL STICK adjust the SCT to obtain the best view of the SCT RESOLUTION CHART held in the Optics line of sight.

6.2.12.6.2 Note the chart contains sets of lines. View each set of lines to determine the lowest numbered set in which the resolution between lines (ability to distinguish separate lines within a set) can be made. The SCT shall have a resolution of at least 3 arc minutes at the center of the field of view.

6.2.12.7 Slave Telescope Mode Checks

6.2.12.7.1 Verify/perform OPTICS POWER ON TEST per paragraph 6.2.3.2.

6.2.12.7.2 Set/Verify following switches on G&N INDICATOR CONTROL PANEL:

a. TELESCOPE TRUNNION - SLAVE to SXT

b. CONTROLLER COUPLING - DIRECT

c. CONTROLLER SPEED - HI

6.2.12.7.3 Monitor OCDU's by entering VERB 16 NOUN 91 into K-148. Press ENTER.

6.2.12.7.4 Set OPTICS MODE to MAN.

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6.2.12.7.5 Using the Optics Hand Controller drive the optics until:

R1 = +010.00±001.00 (SHAFT)
R2 = +10.000±01.000 (TRUNNION)

6.2.12.7.6 Verify on the CRT and Optics Panel:

SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = R2 ±0.22 DEG

6.2.12.7.7 Set the TELESCOPE TRUNNION on the G&N INDICATOR CONTROL PANEL to 0°.

6.2.12.7.8 Verify:

SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = 0.0° ±0.22 DEG

R2 approximately equal to value specified in step 6.2.7.5.

6.2.12.7.9 Set the TELESCOPE TRUNNION on the G&N INDICATOR CONTROL PANEL to OFFSET 25°.

6.2.12.7.10 Verify on CRT and Optics Panel:

SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = 25° ±0.22 DEG
R2 approximately equal to value specified in step 6.2.7.5.

6.2.12.7.11 On the G&N INDICATOR CONTROL PANEL set the TELESCOPE TRUNNION to SLAVE to SXT.

6.2.12.7.12 Verify on CRT and Optics Panel:

SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = R2 ±0.22 DEG

6.2.12.7.13 On the GN INDICATOR CONTROL PANEL set the OPTICS MODE to ZERO.
Wait 15 sec.

6.2.12.7.14 Verify on CRT and OPTICS PANEL:

R1 = 000.00±000.02, -000.03
R2 = 00.000±00.006, -00.007

SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = R2 ±0.22 DEG

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- 6.2.12.7.15 If Optics testing will not be continued, set the GN POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.8 SXT Parallelism Tests
- 6.2.12.8.1 Obtain Portable Light Assembly and Adapter Assembly. Remove the plug from base of SXT Eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the Light.
- 6.2.12.8.2 Using the OPTICS CONTROL STICK drive the SXT Trunnion angle to $85.000^{\circ} \pm 5^{\circ}$ as indicated on R2 of the DSKY. Set the CONTROLLER SPEED to LO and drive the SXT Trunnion to $+90.000^{\circ} \pm 0.100^{\circ}$ as indicated on R2 of the DSKY. Insure that the SXT Shaft angle remains at 000.00 ± 0.10 degrees as indicated by R1 on the DSKY.
- 6.2.12.8.3 Sight through the SXT. Two reticle patterns shall be visible. Use the OPTICS CONTROL STICK to adjust the SXT Trunnion angle until the two horizontal reticle lines are coincident. Record the Trunnion CDU angle displayed in R2. The Trunnion CDU angle shall be 90.000 ± 0.010 degrees.
- 6.2.12.8.4 Remove the Portable Light Assembly and Adapter Assembly from the base of the SXT eyepiece. Replace the SXT eyepiece plug.
- NOTE: If Optics testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.9 SXT, CMC FUNCTION CHECK
- 6.2.12.9.1 Set the OPTICS MODE switch to ZERO. After 15 seconds, return the switch MAN.
- 6.2.12.9.2 Sight through the SXT. Using the Control Stick align the SXT StLOS with Optical Target No. 1. When aligned press the MARK pushbutton.
- 6.2.12.9.3 Record the value of R1 and R2 displayed on the CRT.
- 6.2.12.9.4 Sight through the SXT. Using the Control Stick align the SXT StLOS with Optical Target No. 2. When aligned press the MARK pushbutton.
- 6.2.12.9.5 Record the value in R1 and R2 on the DSKY.
- 6.2.12.9.6 Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. After 15 seconds set the switch to MAN, then CMC.
- 6.2.12.9.7 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for R1 from 6.2.12.9.3 into the DSKY and press ENTER. Enter the value for R2 from 6.2.12.9.3 into the DSKY and press ENTER.

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- 6.2.12.9.8 Sight through the SXT. The StLOS should be approximately centered on the Optical Target No. 1. Press the MARK pushbutton and record the value in R1 and R2 on the DSKY. The difference between these values and the corresponding values recorded in 6.2.12.9.3 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.9 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for R1 from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton. Enter the value for R2 from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton.
- 6.2.12.9.10 Sight through the SXT. The StLOS should be approximately centered on the Optical Target No. 2. Press the MARK pushbutton and record the value in R1 and R2 on the DSKY. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.11 Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN.
- 6.2.12.9.12 If OPTICS testing will not continue, set the G&N Power Optics switch on the LEB Lighting Panel to OFF.
- 6.2.13 Optic Slew Rate Test
- 6.2.13.1 Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following signals on the CRT.
- a. +28 VDC OPTICS OPERATE BUS (CG 1530) is +29.0±3.0 VDC.
 - b. OPTX 28V 800 cps 1% 0° ph not flashing on the CRT
 - c. OPTX 28V 800 cps 5% -90° ph not flashing on the CRT
- Set Tracker Switch to OFF.
- 6.2.13.2 Monitor the OCDU's by entering VERB 16 NOUN 55 into K148. Press the ENTER pushbutton. Insure RECORD DSKY and RECORD DOWNLINK on R-145 are on.
- 6.2.13.3 Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS MODE switch on the G&N Indicator Panel to MAN.
- NOTE: Read and understand step 6.2.13.4 before proceeding. Do not hold Control Stick at upper limit more than 10 seconds or exceed a trunnion angle of 85°.

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Trunnion Slew Rate - HI Speed

6.2.13.4 Push and hold the Optics Control Stick to its upper limit. Approximately 2 seconds later press the MARK pushbutton. Immediately record the DSKY display in R2 and R3. Approximately 5 seconds after the first MARK, again press the MARK pushbutton, release the control stick, and record the new display in R2 and R3. The data displayed is in the following form:

- a. R2 = ±XX,XXX (Trunnion LOS angle in deg.)
- b. R3 = +XXX,XX (Time in seconds)

6.2.13.5 Perform the following calculations:

NOTE: In performing calculation b, below, and in similar calculations throughout this test procedure, the following shall be noted and taken into account. It is possible that the second R3 reading may be smaller than the first reading. If so, add an overflow time value of 163.84 sec. to the second reading and then subtract the first reading, in order to obtain Δ time as the difference of the two R3 readings.

- a. Difference between R2 displays = -----(trun, angle)
- b. Difference between R3 displays = -----(time)
- c. $\frac{\text{trun, angle}}{\text{time}} = \text{---deg/sec}$

The Trunnion slew rate shall be 10.0±2.0 deg/sec.

Shaft Slew Rate - HI Speed

6.2.13.6 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.

NOTE: Read and understand step 6.2.13.7 before proceeding. Do not hold Control Stick at right limit for more than 10 seconds or exceed a shaft angle of 250°.

6.2.13.7 Push and hold the Optics Control stick to its right limit. Approximately 2 seconds later press the MARK pushbutton. Immediately record the DSKY display in R1 and R3. Approximately 5 seconds after the first MARK, again press the MARK pushbutton, release the control stick, and record the new display in R1 and R3. The data displayed is in the following form:

- R1 = ±XXX,XX (Shaft angle in deg.)
- R3 = +XXX,XX (Time in seconds)

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6.2.13.8 Perform the following calculations

- Difference between R1 displays = ----- (shaft angle)
- Difference between R3 displays = ----- (time)
- $\frac{\text{shaft angle}}{\text{time}} = \text{----- deg/sec}$

The Shaft Slew Rate shall be 19.5 ± 3.9 deg/sec.

Trunnion Slew Rate - MED Speed

6.2.13.9 Set the OPTICS MODE switch to zero. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the CONTROLLER SPEED switch to MED.

NOTE: Read and understand 6.2.13.10 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.

6.2.13.10 Push and hold the Optics Control Stick to its upper limit. Approximately 2 seconds later press the MARK pushbutton. Immediately record the DSKY display in R2 and R3. Approximately 10 seconds after the first MARK, again press the MARK pushbutton, release the control stick, and record the new display in R2 and R3. The data displayed is in the following form:

- R2 = +XX.XXX (Trunnion LOS Angle in degrees)
- R3 = +XXX.XX (Time in seconds)
- $\frac{\text{Trunnion angle}}{\text{Time}} = \text{----- deg/sec}$

The Trunnion slew rate shall be 1.0 ± 0.2 deg/sec.

Shaft Slew Rate - MED Speed

6.2.13.11 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.

NOTE: Read and understand 6.2.13.12 before proceeding. Do not hold control stick at right limit for more than 20 seconds.

6.2.13.12 Push and hold the Optics Control Stick to its right limit. Approximately 2 seconds later press the MARK pushbutton. Immediately record the DSKY display in R1 and R3. Approximately 10 seconds after the first MARK, again press the MARK pushbutton, release the control stick, and record the new display in R1 and R3. The data displayed is in the following form:

- R1 = +XXX.XX (Shaft Angle in degrees)
- R3 = +XXX.XX (Time in seconds)

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6.2.13.13 Perform the following calculations

- Difference between R1 displays = ----- (Shaft Angle)
- Difference between R3 displays = ----- (Time)
- $$\frac{\text{Shaft Angle}}{\text{Time}} = \text{--- deg/sec}$$

The Shaft Slew Rate shall be 2.0 ± 0.4 deg/sec.

Trunnion Slew Rate - LO Speed

6.2.13.14 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the CONTROLLER SPEED switch to LO.

NOTE: Read and understand 6.2.13.15 before proceeding.
Do not hold control stick at upper limit for more than 30 seconds.

6.2.13.15 Push and hold the Optics Control stick to its upper limit. Approximately 2 seconds later press the MARK pushbutton. Immediately record the DSKY display in R2 and R3. Approximately 10 seconds after the first MARK, again press the MARK pushbutton, release the control stick, and record the new display in R2 and R3. The data displayed is in the following form:

- R2=+XX.XXX (Trunnion LOS Angle in degrees)
- R3=+XXX.XX (Time in seconds)

6.2.13.16 Perform the following calculations

- Difference between R2 displays = XX.XXX (Trunnion Angle)
- Difference between R3 displays = XXX.XX (Time)
- $$\frac{\text{Trunnion Angle}}{\text{Time}} = \text{--- deg/sec}$$

The Trunnion Slew Rate shall be 0.10 ± 0.02 deg/sec.

Shaft Slew Rate - LO Speed

6.2.13.17 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.

NOTE: Read and understand 6.2.13.18 before proceeding. Do not hold control stick at right limit for more than 20 seconds.

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6.2.13.18 Push and hold the Optics Control stick to its right limit. Approximately 2 seconds later press the MARK pushbutton. Immediately record the DSKY display in R1 and R3. Approximately 10 seconds after the first MARK, again press the MARK pushbutton, release the control stick, and record the new display in R1 and R3. The data displayed is in the following form:

- a. R1= +XXX.XX (Shaft Angle in degrees)
- b. R3= +XXX.XX (Time in seconds)

6.2.13.19 Perform the following calculations:

- a. Difference between R1 displays = ---- (Shaft Angle)
- b. Difference between R3 displays = ---- (Time)
- c. $\frac{\text{Shaft Angle}}{\text{Time}} = \text{--- deg/sec}$

The Shaft Slew Rate shall be 0.20 ± 0.04 deg/sec.

6.2.13.20 If OPTICS testing will not continue; set the G/N Power-Optics switch on the LEB Lighting Control Panel to OFF.

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- 6.2.14 Stabilization Loop Step Response Test.
- 6.2.14.1 Proceed with this test if the Operate Power On Test of 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform the Turn On Procedure of 6.2.5.2 before proceeding.
- 6.2.14.2 Insure that the Carry-on Command Stimuli Unit, Model No. C14-200, is installed and connected.
- 6.2.14.3 Enter VERB 36 into K148. Press the ENTER pushbutton, then the ERROR RESET pushbutton.
- 6.2.14.4 Inner Gimbal Response Test.
- 6.2.14.4.1 Enter code 2032000000 in C-START Module 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2117 IGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.4.2 Enter VERB 41 NOUN 20 into K148. Press ENTER pushbutton.
- 6.2.14.4.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.4.4 Enter VERB 42 into K148. Press ENTER.
- 6.2.14.4.5 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 90 seconds.
- 6.2.14.4.6 Enter 0001 into R154. Verify and execute to apply +28 VDC ACE ENABLE to the PSAAM.
- 6.2.14.4.7 Enter 1000 into R155. Verify and execute to enter a DC step into the 1G stabilization loop.
- CAUTION: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.4.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.4.9 Enter 0000 into 4A2-A6-R155; the top part of switch should be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the 1G Stabilization Loop. The bottom part of switch shall be extinguished.
- 6.2.14.4.10 After the transient has died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.

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- 6.2.14.4.10.1 The inner gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.4.10.2 The maximum number of overshoots on the IGA Servo Error signals shall be three.
- 6.2.14.5 Middle Gimbal Response Test.
- 6.2.14.5.1 Enter code 2028000000 into C-START MODULE 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2147 MGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.5.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.5.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.5.4 Enter VERB 42 into K148. Press ENTER.
- 6.2.14.5.5 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 90 seconds.
- 6.2.14.5.6 Enter 0100 into 4A2-A6-R155. The top part of switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.5.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the MG Stabilization Loop.
- CAUTION: If the transient caused by the step input does not die within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.5.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.5.9 Enter 0000 into 4A2-A6-R155. The top part of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.
- 6.2.14.5.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.5.10.1 The middle gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.5.10.2 The maximum number of overshoots on the MGA Servo Error signals shall be three.

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- 6.2.14.6 Outer Gimbal Response Test.
- 6.2.14.6.1 Enter code 2026000000 in C-START Module 4A1-A5-C156. Press XEQ/SEAL Pushbutton to call up CG 2177 OGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.6.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.6.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.6.4 Enter VERB 42 into K148. Press ENTER pushbutton.
- 6.2.14.6.5 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 90 seconds.
- 6.2.14.6.6 Enter 0010 into 4A2-A6-R155. The top half of the switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.6.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the OG Stabilization Loops.
- NOTE: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.6.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.6.9 Enter 0000 into 4A2-A6-R155. The top half of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the OG Stabilization Loop.
- 6.2.14.6.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.6.10.1 The outer gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.6.10.2 The maximum number of overshoots on the OGA Servo Error Signals shall be three.
- 6.2.14.7 Enter VERB 40 NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.14.7.1 Enter VERB 41 NOUN 20 into K148. Press the ENTER pushbutton.

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- 6.2.14.7.2 Enter +00000 into K148. Press the ENTER pushbutton.
6.2.14.7.3 Enter +00000 into K148. Press the ENTER pushbutton.
6.2.14.7.4 Enter +00000 into K148. Press the ENTER pushbutton.
6.2.14.7.5 Enter 0000 into R154. Verify and execute to remove +28 VDC ACE ENABLE.

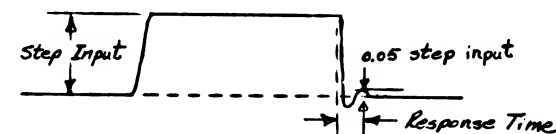


Figure 1. Typical Step Input Response

- 6.2.15 IRIG Scale Factor Test
- 6.2.15.1 Perform Master Initialization 6.2.5.3 before proceeding.
- 6.2.15.2 Verify that the DMU OPERATE power has been applied for a minimum of 1 hour, and that at least 1 hour has elapsed since running of the Gimbal Friction Test, 6.2.7.
- 6.2.15.3 Set up the Analog Recorders to monitor the following signals:
- a. CG 2117 IG SERVO ERROR
 - b. CG 2147 MG SERVO ERROR
 - c. CG 2177 OG SERVO ERROR
 - d. CG 2120 IG TM CURRENT
 - e. CG 2150 MG TM CURRENT
 - f. CG 2180 OG TM CURRENT
- 6.2.15.3.1 Start the analog recorder chart drive using a chart speed of 1 mm/sec. The recorder shall run for the duration of 6.2.15.
- 6.2.15.4 Enter VERB 92 into K148. Press the ENTER pushbutton.
- 6.2.15.5 Enter 00005 into K148. Press the ENTER pushbutton. Program 07 shall be displayed.
- 6.2.15.6 VERB 06 NOUN 41 shall flash on CRT and the following displayed in R1 and R2:
- R1 = +xxxxxx (some Nav. Base azimuth)
 - R2 = +xxxxxx (some test site latitude; see Table I)

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6.2.15.7 If the values displayed in R1 and R2 are correct, proceed with test, if not perform the following sequence:

- To correct R1, on the K-Start enter VERB 21, press ENTER pushbutton, \pm xxx.xx, press ENTER (\pm xxx.xx is correct nav. base azimuth).
- To correct R2, on the K-Start enter VERB 22, press ENTER pushbutton, \pm xx.xxx, press ENTER (obtain correct site latitude from Table I).

Verify that the values in R1 and R2 are correct.

| TABLE I | |
|------------|----------|
| SITE | LATITUDE |
| NAA | +33.921 |
| MSC | +29.556 |
| KSC MSO | +28.523 |
| KSC VAB | +28.585 |
| KSC PAD 39 | +28.607 |

6.2.15.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00001 ENTR

NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.8.

6.2.15.9 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+X IRIG Scale Factor error in part per million, Position +00001).

6.2.15.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00002 ENTR

NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.10.

6.2.15.11 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor Error in parts per million Position +00002).

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- 6.2.15.12 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00003 ENTR
- NOTE: If PROG lamp changes from 07 to 00 during the next step, or
PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat
steps 6.2.15.4 through 6.2.15.7 and 6.2.15.12.
- 6.2.15.13 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and
record from CRT DSKY Row 1 (-Z IRIG Scale Factor error in parts per
million, Position +00003).
- 6.2.15.14 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
-00001 ENTR
- NOTE: If PROG lamp changes from 07 to 00 during the next step, or
PROG ALARM lamp is on, enter VERB 38 ENTR and repeat
steps 6.2.15.4 through 6.2.15.7 and 6.2.15.14.
- 6.2.15.15 In approximately 160 seconds, VERB 07 NOUN 98 shall flash. Read and
record from CRT DSKY Row (-X IRIG Scale Factor error in parts per
million, Position -00001).
- 6.2.15.16 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
-00002 ENTR
- NOTE: If PROG lamp changes from 07 to 00 during the next step, or
PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat
steps 6.2.15.4 through 6.2.15.7 and 6.2.15.16.
- 6.2.15.17 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and
record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per
million, Position -00002).
- 6.2.15.18 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
-00003 ENTR
- NOTE: If PROG lamp changes from 07 to 00 during the next step on
PROG ALARM is ON, enter VERB 36 ENTR and repeat steps
6.2.15.4 through 6.2.15.7 and 6.2.15.18.

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- 6.2.15.19 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position -00003).
- 6.2.15.20 Repeat steps 6.2.15.8 through 6.2.15.19 twice to obtain second and third set of data.
- 6.2.15.21 Terminate this test by entering in K-148: VERB 34 ENTER
- 6.2.15.22 The average of the three readings of Scale Factor Error for the 6 positions shall be 0 ± 1750 PPM.
- 6.2.15.23 After completion of all test numbers, stop the analog recorders.
- 6.2.15.24 Enter VERB 40 NOUN 20, ENTER into K148.
- 6.2.15.25 Enter the following into K148:
- a. VERB 41 NOUN 20, ENTER
 - b. +00000, ENTER
 - c. +00000, ENTER
 - d. +00000, ENTER
- 6.2.16 IMU Performance Test
- 6.2.16.1 Proceed with this test if the Operate Power On Test of 6.2.3 or the Turn On Procedure of 6.2.5.2 has been completed and system operation has not been interrupted. If the system operation has been interrupted, perform Turn On Procedure of 6.2.5.2 before proceeding with this test.
- 6.2.16.2 Enter VERB 01 NOUN 10 into K148. Press the ENTER pushbutton. Enter 00003 into K148. Press the ENTER pushbutton. Record R1 = AAAAA and the time of day.
- 6.2.16.3 Enter VERB 21 NOUN 02 into K148. Press the ENTER pushbutton. Enter 01300 into K148. Press ENTER. Enter AAAAA into K148. Press ENTER.
- 6.2.16.4 Enter VERB 06 NOUN 02 into K148. Press ENTER. Enter 01300 into K148. Press ENTER. Record R1 = BBBB.
- 6.2.16.5 Perform the following calculations:
- a. $\frac{R1 (BBBB) \times 5.12}{3600} = CCCC.C$ (hrs. in high order scaler channel 3)
 - b. $23.3 - CCC.C = DDDDD$ Hrs.
 - c. Add DDDDD to time of day recorded in step 1.

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Do NOT enter any of the PIPA scale factor tests within -0.2 hours of the time of day calculated in step 6.2.16.5.c. This is the time at which the high order scaler, channel 3, will overflow. If a PIPA scale factor test is being performed at this time, unacceptable test results will occur.

6.2.16.6 Verify that the IMU Operate Power has been applied for at least one hour.

6.2.16.7 Test Initiation.

6.2.16.7.1 Enter the following into the K-Start:

- a. VERB 01 NOUN 01, ENTER
- b. 00362, ENTER
- Record R1 = XXXXX

6.2.16.7.2 Enter the following into the K-Start:

- a. VERB 21 NOUN 01, ENTER
- b. 00362, ENTER
- c. XXXXY', ENTER where Y' is determined from Table XI and XXXX is that recorded in 6.2.16.7.1

TABLE XI

| Y (from 6.2.16.7.1) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---------------------|---|---|---|---|---|---|---|---|
| Y' | 2 | 3 | 2 | 3 | 6 | 7 | 6 | 7 |

6.2.16.7.3 Enter VERB 92 into K148. Press the ENTER pushbutton.

6.2.16.7.4 Enter 00001 into K148. Press the ENTER pushbutton.

6.2.16.7.5 On the CRT, DSKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.

6.2.16.7.6 If values for R1 and R2 are correct, proceed to next step. If values for R1 and R2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR
+XXX.XX ENTR (Correct navigation base azimuth ± 0.50 deg)
+XX.XXX ENTR (Correct site latitude from Table XX)
Verify values in R1 and R2 are correct.

TABLE XX

| LOCATION | LATITUDE |
|----------|----------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC-MSO | +28.523 |
| KSC-VAB | +28.585 |
| KSC-PAD | +28.607 |

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6.2.16.7.7 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.8 On CRT, DSKY display, verify R1 = +00900 (Time),
R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position).
If values for R1, R2 and R3 are correct, proceed to next step. If
values for R1, R2 and R3 are incorrect, enter the following sequence
into K-148:

VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00001 ENTR (Test Position Entry)

6.2.16.7.9 On K-148 enter the following sequence:

VERB 33 ENTR

6.2.16.7.10 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the
CRT DSKY display, record R2 (+NBDY) Position +00001.

6.2.16.7.11 On K-148 enter the following sequence:

VERB 33 ENTR

6.2.16.7.12 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT,
record R1 and R2 (+X PIPAS) Position +00001. Row 1 is whole part, Row
2 is fractional part, Units are cm/sec².

6.2.16.7.13 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.14 On CRT DSKY displays, verify R1 = +00900, R2 = +00000, and R3 = +00002.

If values for R1, R2 and R3 are correct, proceed to next step. If values
for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00002 ENTR (Test Position Entry)

6.2.16.7.15 On K-148 enter the following sequence:

VERB 33 ENTR

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- 6.2.16.7.16 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (+NBDZ) position +00002.
- 6.2.16.7.17 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.2.16.7.18 In approximately 90 secs. VERB 06 NOUN 98 shall flash. From the CRT, record R1 and R2 (-X PIPAG) Position +00002.
- 6.2.16.7.19 On K-148 enter the following sequence:
- VERB 21 NOUN 01 ENTR
00407 ENTR
77757 ENTR
VERB 21 NOUN 01 ENTR
00411 ENTR
00020 ENTR
VERB 33 ENTR
- 6.2.16.7.20 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (-NBDX + ADIAX) Pos. +00002. Record CRT CDU gimbal angle indications and time.
- 6.2.16.7.21 On K-148 enter the following sequence:
- VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.22 On CRT, DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00003.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00003 ENTR (Test Position Entry)
- 6.2.16.7.23 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.2.16.7.24 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (-NBDX) Position +00003.
- 6.2.16.7.25 On K-148 enter the following sequence:
- VERB 33 ENTR

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- 6.2.16.7.26 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2 (+Z PIPAG) Position +00003.
- 6.2.16.7.27 On K-148 enter the following sequence:
- VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.28 On the CRT, DSKY display verify R1 = +00900, R2 = 00000, and R3 = +00004.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00004 ENTR (Test Position Entry)
- 6.2.16.7.29 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.2.16.7.30 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (+NBDY + ADSRAY) Position +00004.
- 6.2.16.7.31 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.2.16.7.32 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2 (-Z PIPAG) Position +00004.
- 6.2.16.7.33 On K-148 enter the following sequence:
- VERB 21 NOUN 01 ENTR
00405 ENTR
00020 ENTR
VERB 21 NOUN 01 ENTR
00407 ENTR
77757 ENTR
VERB 33 ENTR
- 6.2.16.7.34 In approximately 67 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display record R2 (+NBDZ + ADIAZ) Position +00004. Record CRT CDU gimbal angle indications and time.

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- 6.2.16.7.35 On K-148 enter the following sequence:
- VERB 33 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.36 From the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00005
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00005 ENTR (Test Position Entry)
- 6.2.16.7.37 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.2.16.7.38 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset. The PROG alarm shall extinguish.
- 6.2.16.7.39 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2 (+Y PIPAG) Position +00005.
- 6.2.16.7.40 On K-148 enter the following sequence:
- VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.41 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00006.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2, and R3 are incorrect, enter the following sequence into K-148.
- VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00006 ENTR (Test Position Entry)
- 6.2.16.7.42 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.2.16.7.43 The PROG Alarm and GIMBAL LOCK lamps shall light. Press Error Reset. The PROG alarm lamp shall extinguish.
- 6.2.16.7.44 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2. (-Y PIPAG) Position +00006.

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- 6.2.16.7.45 On K-148 enter the following sequence:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.46 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00007.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2, and R3 are incorrect, enter the following sequence into K-148:
VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00007 ENTR (Test Position Entry)
- 6.2.16.7.47 On K-148 enter the following sequence:
VERB 33 ENTR
- 6.2.16.7.48 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (+.707 ADSRAX-NBDX) Position +00007.
- 6.2.16.7.49 On K-148 enter the following sequence:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.50 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00008.
- 6.2.16.7.51 On K-148 enter the following sequence:
VERB 33 ENTR
- 6.2.16.7.52 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 [-.707 (NBDZ + NBDY) +.05 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] . Position +00008.
- 6.2.16.7.53 On K-148 enter the following:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.54 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00009.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00009 ENTR (Test Position Entry)

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| 6.2.16.7.55 | | |
| On K-148 enter the following sequence: | | |
| VERB 33 | ENTR | |
| 6.2.16.7.56 | | |
| In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADSRAZ) Position +00009. | | |
| 6.2.16.7.57 | | |
| On K-148 enter the following sequence: | | |
| VERB 34 | ENTR | |
| VERB 06 | NOUN 98 shall flash | |
| 6.2.16.7.58 | | |
| On the CRT DSKY display, verify R1 = +00900; R2 = +00000, and R3 = +00010. | | |
| If values for R1, R2, and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148: | | |
| VERB 25 | ENTR | |
| +00900 | ENTR (Test Time in Seconds) | |
| +00000 | ENTR (Test Index Number) | |
| +00010 | ENTR (Test Position Entry) | |
| 6.2.16.7.59 | | |
| On K-148 enter the following sequence: | | |
| VERB 33 | ENTR | |
| 6.2.16.7.60 | | |
| In approximately 12 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display record R2 <u>707</u> (NBDY - NBDX) +.5 (AD:AY - ADLAX) +.5 ADSRAZ Position +00010. | | |
| 6.2.16.7.61 | | |
| Terminate this test by entering in K-148 the following: | | |
| VERB 36 | ENTR | |
| 6.2.16.7.62 | | |
| On K-148 enter the following sequence: | | |
| VERB 41 | NOUN 20 | ENTR |
| +00000 | | ENTR |
| +00000 | | ENTR |
| +00000 | | ENTR |
| 6.2.16.8 | | |
| Deleted | | |
| 6.2.16.9 | | |
| Deleted | | |
| 6.2.16.10 | | |
| Calculations | | |

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TABLE XXI

| Position No. as Displayed in R3 | Quantity Being Measured |
|------------------------------------|--|
| +00001 | +NBDY +X PIPA G |
| +00002 | +NBDZ -X PIPA G -NBDX + ADLAX |
| +00003 | -NBDX +Z PIPA G |
| +00004 | +NBDY + ADSRAY -Z PIPA G +NBDZ + ADIAZ |
| +00005 | +Y PIPA G |
| +00006 | -Y PIPA G |
| +00007 | -NBDX + .707 ADSRAX |
| +00008 | .707 (NBDZ - NBDY) +.5 (ADIAZ - ADIAY) +.5 (ADSRAY + ADSRAZ) |
| +00009 | -NBDZ + .707 ADSRAZ |
| +00010 | .707 (NBDY - NBDX) +.5 (ADIAY - ADIAZ) +.5 (ADSRAX) |

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6.2.16.10.1 Measured Values

| | Line | Position No. | Step No. | Parameter | Recorded Value |
|----------------|------|--------------|-------------|---|----------------|
| 6.2.16.10.1.1 | 1 | +00001 | 6.2.16.7.10 | +NBDY | R2 |
| 6.2.16.10.1.2 | 2 | +00001 | 6.2.16.7.12 | +XPIPAG | R1 • R2 |
| 6.2.16.10.1.3 | 3 | +00002 | 6.2.16.7.16 | +NBDZ | R2 |
| 6.2.16.10.1.4 | 4 | +00002 | 6.2.16.7.18 | -X PIPAG | R1 • R2 |
| 6.2.16.10.1.5 | 5 | +00002 | 6.2.16.7.20 | -NBDX + ADIAX | R2 |
| 6.2.16.10.1.6 | 6 | +00003 | 6.2.16.7.24 | -NBDX | R2 |
| 6.2.16.10.1.7 | 7 | +00003 | 6.2.16.7.26 | +ZPIPAG | R1 • R2 |
| 6.2.16.10.1.8 | 8 | +00004 | 6.2.16.7.30 | +NBDY + ADSRAY | R2 |
| 6.2.16.10.1.9 | 9 | +00004 | 6.2.16.7.32 | -ZPIPAG | RL • R2 |
| 6.2.16.10.1.10 | 10 | +00004 | 6.2.16.7.34 | +NBDZ + ADIAZ | R2 |
| 6.2.16.10.1.11 | 11 | +00005 | 6.2.16.7.39 | +YPIPAG | R1 • R2 |
| 6.2.16.10.1.12 | 12 | +00006 | 6.2.16.7.44 | -YPIPAG | RL • R2 |
| 6.2.16.10.1.13 | 13 | +00007 | 6.2.16.7.48 | -NBDX + .707 ADSRAX | R2 |
| 6.2.16.10.1.14 | 14 | +00008 | 6.2.16.7.52 | .707 (-NBDZ-NBDY) +.5 (ADIAX-ADIAZ) +.5 (ADSRAY + ADSRAZ) | R2 |
| 6.2.16.10.1.15 | 15 | +00009 | 6.2.16.7.56 | -NBDZ + .707 ADSRAZ | R2 |
| 6.2.16.10.1.16 | 16 | +00010 | 6.2.16.7.60 | .707 (NBDY - NBDX) +.5 (ADIAZ - ADIAX) +.5 ADSRAX | R2 |

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6.2.16.10.2 Obtain data from last historical IRIG and PIPA test and complete Table X_{1-1} .

Table X_{1-1}

| Parameter | Units | Recorded Value |
|-------------------|---------------------|----------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRZ | meru/g | |
| ADLAX | meru/g | |
| ADLAY | meru/g | |
| ADIAZ | meru/g | |
| X PIPA S.F. Error | PPM | |
| Y PIPA S.F. Error | PPM | |
| Z PIPA S.F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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6.2.16.10.3 Obtain data from the second last historical IRIG and PIPA test and complete Table X₁₋₂.

TABLE X₁₋₂

| Parameter | Units | Recorded Value |
|-------------------|---------------------|----------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRZ | meru/g | |
| ADTAX | meru/g | |
| ADLAY | meru/g | |
| ADIAZ | meru/g | |
| X PIPA S.F. Error | PPM | |
| Y PIPA S.F. Error | PPM | |
| Z PIPA S.F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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6.2.16.10.4 Obtain data from the third last historical IRIG and PIPA test and complete Table X_{1-3} .

TABLE X_{1-3}

| Parameter | Units | Recorded Value |
|-------------------|---------------------|----------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRZ | meru/g | |
| ADIAx | meru/g | |
| ADIAy | meru/g | |
| ADIAz | meru/g | |
| X PIPA S.F. Error | PPM | |
| Y PIPA S.F. Error | PPM | |
| Z PIPA S.F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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6.2.16.10.5 Compute the PIPA Scale Factor error in parts per million from the values recorded in 6.2.16.10.1 and record in Table X_1 .

- a. PIPA S.F. Error = $\left[\frac{2 \text{ local } g}{+PIPAG - (PIPAG)} - 1.000000 \right] 10^6$
- b. X PIPA S.F. Error = $\left[\frac{2 \text{ local } g}{\text{line 2} - \text{line 4}} - 1.000000 \right] 10^6$
- c. Y PIPA S.F. Error = $\left[\frac{2 \text{ local } g}{\text{line 11} - \text{line 12}} - 1.000000 \right] 10^6$
- d. Z PIPA S.F. Error = $\left[\frac{2 \text{ local } g}{\text{line 7} - \text{line 9}} - 1.000000 \right] 10^6$

The PIPA S.F. Error shall not exceed ± 2000 PPM

| TABLE XXII Local Gravity values | |
|---------------------------------|--------------------------------------|
| Location | Local Gravity (cm/sec ²) |
| NAA | 979.56 |
| MSC | 979.29 |
| KSC | 979.24 |

6.2.16.10.6 Compute the PIPA Bias in cm/sec² from the values recorded in 6.2.16.10.1 and record in Table X_1 .

- a. PIPA Bias = $\frac{+PIPAG + (-PIPAG)}{2}$
- b. X PIPA Bias = $\frac{\text{line 2} + \text{line 4}}{2}$
- c. Y PIPA Bias = $\frac{\text{line 11} + \text{line 12}}{2}$
- d. Z PIPA Bias = $\frac{\text{line 7} - \text{line 9}}{2}$

The PIPA Bias shall not exceed ± 2.28 cm/sec².

6.2.16.10.7 Calculate NBD, ADSRA, and ADIA from the values recorded in 6.2.16.10.1 and record in Table X_1 .

- a. NBDX = - (line 6) =
NBDX = - (line 1) =
NBDZ = line 3 =
NBD shall not exceed ± 15 meru.

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6.2.16.10.7 (continued)

b. $ADSRAX = \frac{(\text{line 13} - \text{line 6})}{.707} =$

$ADSRAY = \text{line 8} - \text{line 1}$

$ADSRAX = \frac{\text{line 15} + \text{line 3}}{.707}$

ADSRAX shall not exceed ± 40 meru/g.

c. $ADIAX = \text{line 5} - \text{line 6}$

$ADIAZ = \frac{\text{line 16} - .707 (\text{NBDY} - \text{NBDX}) - .5 (\text{ADSRAX} - \text{ADIAZ})}{.5}$

$ADIAZ = \text{line 10} - \text{line 3}$

ADIA shall not exceed ± 100 meru/g

6.2.16.10.8 Perform the following calculations for each term in Table X_1 , and record the results in Table D.

$D_1 = |X_{1-1} - X_1|$

$D_2 = |X_{1-1} - X_1| + |X_{1-2} - X_{1-1}|$

$D_3 = |X_{1-3} - X_{1-2}| + |X_{1-2} - X_{1-1}| + |X_{1-1} - X_1|$

X_1 = Data point just obtained

X_{1-1} = last historical data point

X_{1-2} = second last historical data point

X_{1-3} = third last historical data point

NOTE: D_1 calculations begin with the first data point after ISS Pre-Vib; D_2 calculations begin with the second data point after ISS Pre-Vib; D_3 calculations begin with the third data point after Pre-Vib.

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TABLE X₁

| Parameter | Units | Calculated Value |
|-------------------|---------------------|------------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRAZ | meru/g | |
| ADLAX | meru/g | |
| ADLAY | meru/g | |
| ADLAZ | meru/g | |
| X PIPA S.F. Error | PPM | |
| Y PIPA S.F. Error | PPM | |
| Z PIPA S.F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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TABLE D

| PARAMETER | UNITS | D ₁ | MAX. | D ₂ | MAX. | D ₃ | MAX. |
|-------------------|---------------------|----------------|------|----------------|------|----------------|------|
| NBDX | meru | | 6 | | 9 | | 11 |
| NBDY | meru | | 6 | | 9 | | 11 |
| NBDZ | meru | | 6 | | 9 | | 11 |
| ADSRAX | meru/g | | 14 | | 21 | | 25 |
| ADSRAY | meru/g | | 14 | | 21 | | 25 |
| ADSRAZ | meru/g | | 14 | | 21 | | 25 |
| ADLAX | meru/g | | 17 | | 33 | | 40 |
| ADLAY | meru/g | | 17 | | 33 | | 40 |
| ADLAZ | meru/g | | 17 | | 33 | | 40 |
| X PIPA S.F. Error | PPM | | 400 | | 500 | | 600 |
| Y PIPA S.F. Error | PPM | | 400 | | 500 | | 600 |
| Z PIPA S.F. Error | PPM | | 400 | | 500 | | 600 |
| X PIPA Bias | cm/sec ² | | 0.5 | | 0.7 | | 0.9 |
| Y PIPA Bias | cm/sec ² | | 0.5 | | 0.7 | | 0.9 |
| Z PIPA Bias | cm/sec ² | | 0.5 | | 0.7 | | 0.9 |

6.2.16.10.9 Failure to meet the above criteria shall result in retest according to 5.4.2.

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- 6.2.17 SXT-NB-Fine Alignment Test
- 6.2.17.1 Perform Master Initialization 6.2.5.3 before proceeding.
- 6.2.17.2 The G&N shall have had OPERATE power applied for a minimum of 1 hour.
- 6.2.17.3 Set the G/N POWER-OPTICS switch to OPTICS. Verify that +28 VDC OPTICS OPERATE BUS (CG 1530) is +28.0±3.0 VDC. Verify that the OPTX 28V 800 cps 1% 0° ph (CG 1211) and OPTX 28V 800 cps 5% -90° ph (CG 1212) are not flashing on the CRT.
- 6.2.17.4 Enter VERB 01 NOUN 10 into K-148. Press the ENTER pushbutton. Enter 00003 into K-148. Press the ENTER pushbutton. Record R1 = AAAAA.
- If the recorded value is within any of the sets of limits given in Table I proceed with the test. If the recorded value is NOT within any of the sets of limits wait 30 minutes and then repeat this step.

TABLE I

| MIN VALUE | | MAX VALUE |
|-----------|-------|-----------|
| 00000 | AAAAA | 03242 |
| 04000 | AAAAA | 07242 |
| 10000 | AAAAA | 13242 |
| 14000 | AAAAA | 17242 |
| 20000 | AAAAA | 23242 |
| 24000 | AAAAA | 27242 |
| 30000 | AAAAA | 33242 |
| 34000 | AAAAA | 37242 |

- 6.2.17.5 On the G&N Indicator Control Panel set the following switches to the position indicated.
- a. TELESCOPE TRUNNION to SLAVE to SXT
 - b. CONTROLLER COUPLING to DIRECT
 - c. CONTROLLER SPEED to LO
 - d. OPTICS MODE to ZERO
- 6.2.17.6 Enter the following into the DSKY:
- a. VERB 01 NOUN 01, ENTER
 - b. 00362, ENTER
- Record R1 = XXXXX

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6.2.17.7 Enter the following into the DSKY:

- VERB 21 NOUN 01, ENTER
- 00362, ENTER
- XXXXY', ENTER where Y' is determined by Table II and XXXX is that recorded above.

TABLE II

| Y (from 6.2.17.8) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------------------|---|---|---|---|---|---|---|---|
| Y' | 2 | 3 | 2 | 3 | 6 | 7 | 6 | 7 |

6.2.17.8 Initiate the test by entering the following sequence into the LEB DSKY.

- VERB 92, ENTER
- 00003, ENTER

6.2.17.9 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data is displayed in R1 and R2 on the DSKY.

- R1 = +13500
- R2 = +xx,xxx (Site Latitude from Table I)

TABLE I

| SITE | LATITUDE |
|------------|----------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC MSO | +28.523 |
| KSC VAB | +28.585 |
| KSC PAD 39 | +28.607 |

6.2.17.10 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If the value displayed is other than +13500 in R1 and the correct Site Latitude in R2, correct the data by entering the following sequence into the DSKY.

- VERB 21, ENTER
- +13500, ENTER
- VERB 22, ENTER
- +xx,xxx, ENTER (+xx,xxx = Site Latitude from Table I)
- VERB 33, ENTER

6.2.17.11 Observe VERB 25 NOUN 97 flashing on the DSKY. Enter the following sequence into the DSKY.

- +00001, ENTER (Position Number)
- +00000, ENTER
- +00001, ENTER

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| 6.2.17.12 | Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3. | | | | | |
| | a. R1 = +xxx.xx (Y _{NB} Azimuth) | | | | | |
| | b. R2 = ±xx.xxx (Y _{NB} Elevation) | | | | | |
| | c. R3 = 00001 | | | | | |
| 6.2.17.13 | If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct Y _{NB} azimuth and elevation, correct the data by entering the following sequence into the DSKY. | | | | | |
| | a. VERB 24, ENTER | | | | | |
| | b. +xxx.xx±002.00 degrees, ENTER (Y _{NB} Azimuth) | | | | | |
| | c. ±xx.xxx±02.000 degrees, ENTER (Y _{NB} Elevation) | | | | | |
| | d. VERB 33, ENTER | | | | | |
| 6.2.17.14 | Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3. | | | | | |
| | a. R1 = +xxx.xx (Z _{NB} Azimuth) | | | | | |
| | b. R2 = ±xx.xxx (Z _{NB} Elevation) | | | | | |
| | c. R3 = 00002 | | | | | |
| 6.2.17.15 | If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct Z _{NB} azimuth and elevation, correct the data by entering the following sequence into the DSKY. | | | | | |
| | a. VERB 24, ENTER | | | | | |
| | b. +xxx.xx±002.00 degrees, ENTER (Z _{NB} Azimuth) | | | | | |
| | c. ±xx.xxx±02.000 degrees, ENTER (Z _{NB} Elevation) | | | | | |
| | d. VERB 33, ENTER | | | | | |
| 6.2.17.16 | Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3. | | | | | |
| | a. R1 = +xxx.xx (Target 1 Azimuth) | | | | | |
| | b. R2 = ±xx.xxx (Target 1 Elevation) | | | | | |
| | c. R3 = 00001 | | | | | |
| 6.2.17.17 | If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct azimuth and elevation for Target 1, correct the data by entering the following sequence into the DSKY. | | | | | |
| | a. VERB 24, ENTER | | | | | |
| | b. +xxx.xx±000.10 degrees, ENTER (Target 1 Azimuth) | | | | | |
| | c. ±xx.xxx±00.010 degrees, ENTER (Target 1 Elevation) | | | | | |
| | d. VERB 33, ENTER | | | | | |

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- 6.2.17.18 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- R1 = +xxx.xx (Target 2 Azimuth)
 - R2 = ±xx.xxx (Target 2 Elevation)
 - R3 = 00002
- 6.2.17.19 If the data displayed is correct proceed to 6.2.17.22. If R1 and R2 do not contain the correct azimuth and elevation for Target 2, correct the data by entering the following sequence into the DSKY.
- VERB 24, ENTER
 - +xxx.xx±00.10 degrees, ENTER (Target 2 Azimuth)
 - ±xx.xxx±00.010 degrees, ENTER (Target 2 Elevation)
- 6.2.17.20 Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN. Enter VERB 33, ENTER into the DSKY.
- 6.2.17.21 When the DSKY displays VERB 51 NOUN 30 flashing and R1 = 00001, on the DSKY set the OPTICS MODE switch on the G&N Indicator Control Panel to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.
- 6.2.17.22 Using the Optics Hand Controller, align the SXT StLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step.
- 6.2.17.23 When the DSKY displays VERB 51 NOUN 30 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement of the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.24 Using the Optics Hand Controller, align the SXT StLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step.
- NOTE: The following two MARKS must be performed as quickly as possible. In no case shall the time between the first and second MARK exceed two minutes.
- 6.2.17.25 After 90 seconds observe the DSKY for VERB 51 and NOUN 30 flashing and R1 = 00001. Set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.

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| 6.2.17.26 | Using the Optics Hand Controller, align the SXT StLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. | | | | | | | | | | |
| 6.2.17.27 | When the DSKY displays VERB 51 NOUN 30 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement of the TPAC, set the OPTICS MODE switch to MANUAL. | | | | | | | | | | |
| 6.2.17.28 | Using the Optics Hand Controller, align the SXT StLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. | | | | | | | | | | |
| 6.2.17.29 | In approximately 7 minutes VERB 06 NOUN 98 shall flash on the DSKY and the test results shall be displayed. R1 and R2 on the DSKY shall display the misalignment of one of the horizontal PIPA's in arc seconds (R1 = whole, R2 = fractional). Record R1 and R2. (See Table II for PIPA displayed.) | | | | | | | | | | |
| 6.2.17.30 | Enter VERB 33 ENTER into the DSKY. When VERB 06 NOUN 98 flashes R1 and R2 on the DSKY shall display the misalignment of the second horizontal PIPA in arc seconds (R1 whole, R2 fractional). (See Table III for PIPA displayed). Record R1 and R2. | | | | | | | | | | |
| 6.2.17.31 | Enter VERB 34 ENTER into the DSKY to terminate the test. Wait 5 seconds. | | | | | | | | | | |
| 6.2.17.32 | Repeat steps 6.2.17.4 and 6.2.17.8 through 6.2.17.31 substituting No. 00002 in 6.2.17.11.a. | | | | | | | | | | |
| 6.2.17.33 | Enter the following sequence into the DSKY: | | | | | | | | | | |
| | a. VERB 36, ENTER | | | | | | | | | | |
| | b. VERB 41 NOUN 20, ENTER | | | | | | | | | | |
| | c. +00000, ENTER | | | | | | | | | | |
| | d. +00000, ENTER | | | | | | | | | | |
| | e. +00000, ENTER | | | | | | | | | | |

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6.2.17.34 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.

Table III. DISPLAY CONDITIONS AT TEST COMPLETION

| Position | SM Orientation | | | Horizontal Misalignment Component | |
|----------|-----------------|-----------------|-----------------|-----------------------------------|-----------------|
| | X _{SM} | Y _{SM} | Z _{SM} | 6.2.17.29 | 6.2.17.30 |
| 1. | UP | SW | SE | Y _{SM} | Z _{SM} |
| 2. | SE | SW | DN | X _{SM} | Y _{SM} |
| 3.* | SE | UP | SW | X _{SM} | Z _{SM} |

*Position 3 is not run in the Spacecraft because of GIMBAL LOCK considerations.

6.2.17.35 Calculations

- 6.2.17.35.1 a. Y_{SM} misalignment = () R₁, R₂
b. Z_{SM} misalignment = () R₁, R₂
c. X_{SM} misalignment = () R₁, R₂
d. Y_{SM} misalignment = () R₁, R₂

6.2.17.35.2 Enter the latest values from 6.2.16 DMU Performance Test.

- a. X PIPA bias = _____ cm/sec²
b. Y PIPA bias = _____ cm/sec²
c. Z PIPA bias = _____ cm/sec²
d. $\theta_x = 210$ (X PIPA bias) = _____ arc sec.
e. $\theta_y = 210$ (Y PIPA bias) = _____ arc sec.
f. $\theta_z = 210$ (Z PIPA bias) = _____ arc sec.

- 6.2.17.35.3 a. Y_{SM} misalignment (Bias corrected) = 6.2.17.35.1a - θ_y = _____ arc sec.
b. Z_{SM} misalignment (Bias corrected) = 6.2.17.35.1b - θ_z = _____ arc sec.
c. X_{SM} misalignment (Bias corrected) = 6.2.16.35.1c - θ_x = _____ arc sec.
d. Y_{SM} misalignment (Bias corrected) = 6.2.17.35.1d - θ_y = _____ arc sec.

The SM misalignment in each orientation, excluding PIPA bias, shall not exceed ± 150 arc seconds.

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6.2.18 Gyrocompassing Test

NOTE: Perform Master Initialization 6.2.5.3 before proceeding.

6.2.18.1 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify that +28 vdc OPTICS OPERATE BUS (CG 1530) is +28.0±3.0 vdc. Verify that the OPTX 28V 800 cps 1% 0° (CG 1211) and OPTX 28V 800 cps 5% -90° (CG 1212) are not flashing on the CRT.

6.2.18.2 Load the Inertial Instrument Calibration Data into the CMC using the following sequence:

| | | |
|----------------------|---------|------|
| VERB 21 | NOUN 01 | ENTR |
| 01727 | | ENTR |
| XXXXX (X PIPA BIAS) | | ENTR |
| | | ENTR |
| 01730 | | ENTR |
| XXXXX (X PIPA S. F.) | | ENTR |
| | | ENTR |
| 01731 | | ENTR |
| XXXXX (Y PIPA BIAS) | | ENTR |
| | | ENTR |
| 01732 | | ENTR |
| XXXXX (Y PIPA S. F.) | | ENTR |
| | | ENTR |
| 01733 | | ENTR |
| XXXXX (Z PIPA BIAS) | | ENTR |
| | | ENTR |
| 01734 | | ENTR |
| XXXXX (Z PIPA S. F.) | | ENTR |
| | | ENTR |
| 01735 | | ENTR |
| XXXXX (NBDX) | | ENTR |
| | | ENTR |
| 01736 | | ENTR |
| XXXXX (NBDY) | | ENTR |
| | | ENTR |
| 01737 | | ENTR |
| XXXXX (NBDZ) | | ENTR |
| | | ENTR |
| 01740 | | ENTR |
| XXXXX (ADLAX) | | ENTR |
| | | ENTR |
| 01741 | | ENTR |
| XXXXX (ADLAY) | | ENTR |
| | | ENTR |

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01742 ENTR
XXXXX (ADIAZ) ENTR
01743 ENTR
XXXXX (ADSRAX) ENTR
01744 ENTR
XXXXX (ADSRAY) ENTR
01745 ENTR
XXXXX (ADSRAZ) ENTR

6.2.18.3 Enter NB Azimuth and Site Latitude (from Table II) and Launch Azimuth into the CMC using the following sequence:

a) VERB 21 NOUN 01 ENTR
2506 ENTR
+XXX.XX ENTR (NB Azimuth)
2510 ENTR
+XXX.XX ENTR (Site Latitude)
2755 ENTR
+XXX.XX ENTR (Launch Azimuth)

TABLE II

| Location | Latitude |
|------------|----------|
| NAA | 33.921 |
| MSC | 29.550 |
| KSC MSO | 28.523 |
| KSC VAB | 28.585 |
| KSC PAD 39 | 28.607 |

6.2.18.4 Enter the following into the DSKY:

a. VERB 01 NOUN 01, ENTER
b. 00362, ENTER

Record R1 = XXXXY

6.2.18.5 Enter the following into the DSKY:

a. VERB 01 NOUN 01, ENTER
b. 00362, ENTER
c. XXXXY'ENTER where Y' is determined by Table I and XXXX is that recorded in 6.2.18.4.

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TABLE I

| | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|
| Y (From 6.2.18.4) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Y' | 2 | 3 | 2 | 3 | 6 | 7 | 6 | 7 |

6.2.18.6 Enter the following into the CMC:

VERB 37 ENTER, 01 ENTER

6.2.18.7 To change the launch azimuth perform the following:

- VERB 78, ENTER
- R1 displays present launch azimuth
- To change launch azimuth enter
VERB 21, ENTER
±XXX.XX ENTER (new launch azimuth)

NOTE: Using the beginning of Prog. 02 as t_0 , initial start time, read/record CDUX, CDUY, and CDUZ every 15 minutes for 120 min. and every 5 minutes for the next 60 minutes.

6.2.18.8 Enter VERB 33, ENTER into the DSKY. On the DSKY observe the PROGRAM display change to 05 after approximately 90 seconds. Approximately 5 minutes later observe the PROGRAM display change to 02.

6.2.18.9 Between 175 minutes and 180 minutes from T_0 set the OPTICS MODE switch on the G&N Indicator Control Panel to Zero.

6.2.18.10 Enter the following into the DSKY:

VERB 21 NOUN 03 ENTER
02553 ENTER
+XXX.XX ±000.01 ENTER (Target No. 1 AZ)
ENTER
02554 ENTER
+00.000 ENTER (Target No. 1 EL)
ENTER
02555 ENTER
+000.00 ±000.01 ENTER (Target No. 2 AZ)
ENTER
02556 ENTER
+00.000 ENTER (Target No. 2 EL)

On the G&N Indicator Control Panel, set the Optics Mode switch to MAN and the controller speed to HI. Drive the StLOS to the approximate position of Target No. 1. Set the Controller Speed switch to LO.

NOTE: Read the following 10 steps before proceeding. These are time critical steps and must be performed as rapidly as possible.

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| 6.2.18.11 | | |
| After 180 minutes from T ₀ enter VERB 52, ENTER into the DSKY. Observe the PROGRAM display on the DSKY change to 03. | | |
| 6.2.18.12 | | |
| When VERB 06 NOUN 41 flashed on the DSKY, insure that R1 and R2 display Target 1 azimuth and elevation. | | |
| a. R1 = +XXX.XX (Target 1 azimuth) | | |
| b. R2 = +XX.XXX (Target 1 elevation) | | |
| 6.2.18.13 | | |
| Verify the data appearing in R1 and R2 and if correct, proceed. If not correct, perform the following sequence: | | |
| a. VERB 24, ENTER | | |
| b. +XXX.XX, ENTER (Target 1 azimuth) | | |
| c. ±XX.XXX, ENTER (Target 1 elevation) | | |
| 6.2.18.14 | | |
| After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY. | | |
| 6.2.18.15 | | |
| When VERB 06 NOUN 41 flashes on the DSKY, insure that R1 and R2 display Target 2 azimuth and elevation. | | |
| a. R1 = XXX.XX (Target 2 azimuth) | | |
| b. R2 = XX.XXX (Target 2 elevation) | | |
| 6.2.18.16 | | |
| Verify the data appearing in R1 and R2 and if correct, perform the following sequence: | | |
| a. VERB 24, ENTER | | |
| b. +XXX.XX, ENTER (Target 2 azimuth) | | |
| c. ±XX.XXX, ENTER (Target 2 elevation) | | |
| 6.2.18.17 | | |
| After the correct readings for R1 and R2 are verified enter VERB 33, ENTER into the DSKY. | | |
| 6.2.18.18 | | |
| Using the Optics Hand Controller, align the SXT StLOS to Target 1 and press MARK pushbutton. If not satisfied with MARK, press the MARK REJECT pushbutton and repeat this step. | | |
| 6.2.18.19 | | |
| Set the CONTROLLER SPEED switch to HI. Using the Optics Hand Controller, drive the SXT StLOS to the approximate position of Target 2. | | |
| 6.2.18.20 | | |
| Set the CONTROLLER SPEED switch to LO. Using the Optics Hand Controller, align the SXT StLOS to Target 2 and press the MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied, press the MARK REJECT pushbutton and repeat this step. | | |

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6.2.18.21 On the DSKY observe the following data displayed:

- a. VERB 06 NOUN 93
- b. R1 = ±XX.XXX (X gyro elevation error, deg. 3 hr.)
- c. R2 = ±XX.XXX (Y gyro elevation error, deg. 3 hr.)
- d. R3 = ±XX.XXX (Z gyro azimuth error, deg. 3 hr.)

Record R1, R2 and R3. The X and Y gyro elevation error shall be 0.00±0.06 degrees and the Z gyro azimuth error shall be 0.00±0.57 degrees.

6.2.18.22 Enter VERB 34, ENTER into the DSKY. Observe the PROGRAM display change to 02. Set the Optics Mode Switch on the G&N Indicator Control Panel to ZERO.

6.2.18.23 Enter VERB 36 into the DSKY. Press the enter pushbutton.

6.2.18.24 Enter VERB 41 NOUN 20 into the DSKY. Press the ENTER pushbutton. Enter +00000 into the DSKY three times. Press the ENTER pushbutton after each entry. Set the G&N Power Optics switch on the LEB Lighting Control Panel to OFF.

6.2.18.25 Data Sheet

| <u>TIME</u> | <u>CDUX</u> | <u>CDUY</u> | <u>CDUZ</u> |
|----------------------|-------------|-------------|-------------|
| t ₀ | | | |
| t ₀ + 15 | | | |
| t ₀ + 30 | | | |
| t ₀ + 45 | | | |
| t ₀ + 60 | | | |
| t ₀ + 75 | | | |
| t ₀ + 90 | | | |
| t ₀ + 105 | | | |
| t ₀ + 120 | | | |
| t ₀ + 125 | | | |
| t ₀ + 130 | | | |
| t ₀ + 135 | | | |
| t ₀ + 140 | | | |
| t ₀ + 145 | | | |
| t ₀ + 150 | | | |
| t ₀ + 155 | | | |

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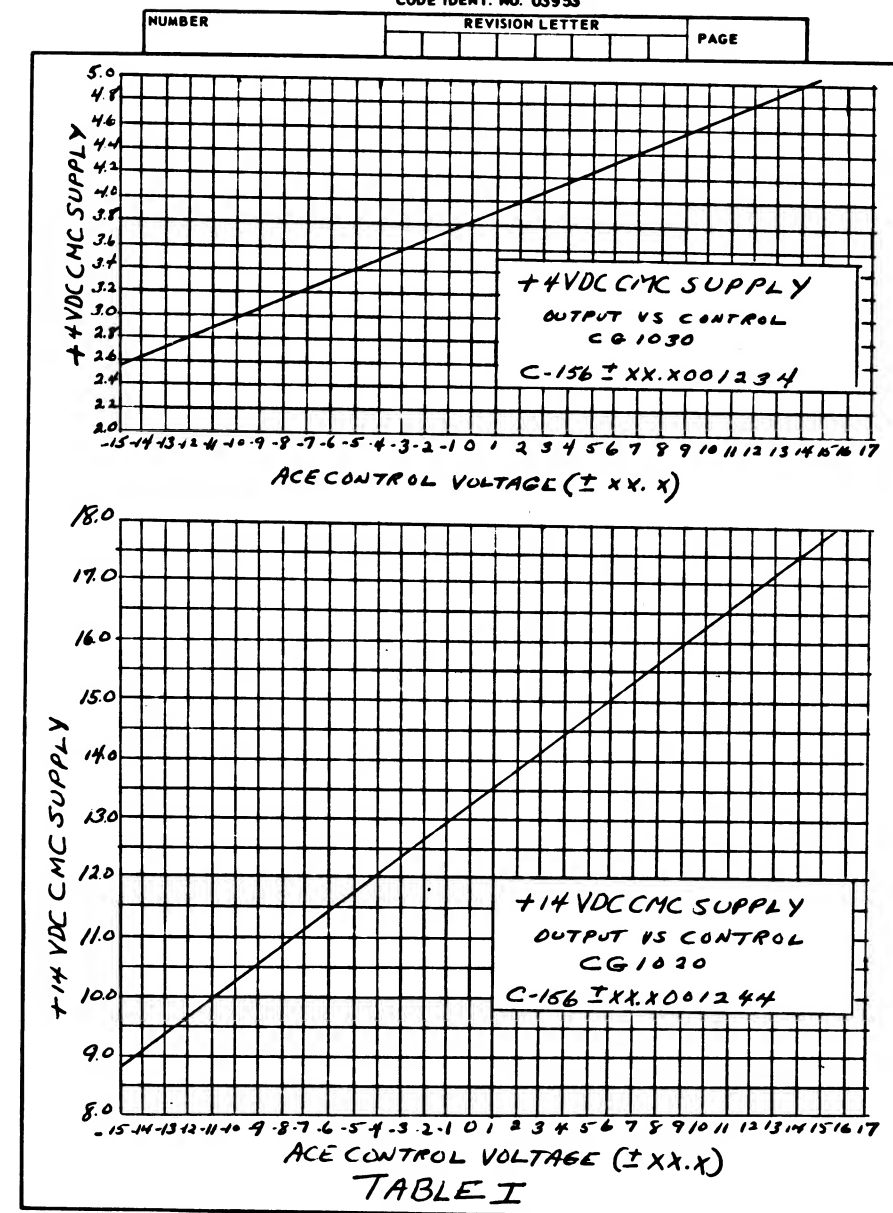
| TIME | CDUX | CDUY | CDUZ |
|---|---|------|------|
| t ₀ + 160 | | | |
| t ₀ + 165 | | | |
| t ₀ + 170 | | | |
| t ₀ + 175 | | | |
| t ₀ + 180 | | | |
| <p>NOTE: 1. Record CDU angles at times indicated. (t₀ is the time at the start of test Prog 02)</p> <p>2. The 2 hr. data (t₀ + 120 minutes) is baseline.</p> <p>TOLERANCE: The tolerance is 0.00±0.06° delta from the 2 hr baseline for CDUX, and 0.00±0.03° delta from the 2 hr baseline for CDUY and CDUZ for 120 minutes to 180 minutes recordings only.</p> | | | |
| 6.2.19 | CMC Voltage Margin Test | | |
| 6.2.19.1 | Verify that the G&N IMU HTR MNA & MNB circuit breakers are engaged, Computer MNA & MNB breakers are engaged, IMU MNA & MNB circuit breakers are not engaged, and the G&N Power - IMU switch on the LEB Lighting Control Panel is in the OFF position. | | |
| 6.2.19.2 | On the PSA Adapter Module set the INHIBIT VOLTAGE FAIL switch to ON. | | |
| <p>Caution: During the performance of this test the +4 VDC CMC Power Supply shall not be operated at less than +2.5 VDC or greater than 5.2 VDC (CG 1030). The +14 VDC CMC Power Supply shall not be operated at less than +8.5 VDC or greater than +17.0 VDC (CG 1020). Rotate the LEB LTS NUMBERS SEL, to approximately center position. Decrease to absolute minimum discernable lighting.</p> <p>Note: The flashing indication of the CMC Power Supplies on CRT may be disregarded for this test. The charts in Table I may be used to determine approximate values for the "XX, X" values of C-156 voltage dial settings corresponding to various power supply voltages.</p> | | | |
| 6.2.19.3 | Into R154 insert 0001. Verify and execute. | | |
| 6.2.19.4 | Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC. | | |
| 6.2.19.5 | Into C156 insert -050001234. Verify and execute. Verify on the CRT that GV0106 is between -4.0 and -6.0 VDC. | | |
| 6.2.19.6 | Into R154 insert 0111. Verify and execute. | | |

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| 6.2.19.7 | | |
| Observe CG 1020, +14 VDC CMC Power Supply, and CG 1030, +4 VDC CMC Power Supply, on the CRT. Repeat 6.2.19.3 through 6.2.19.6 adjusting each C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC and CG 1030 is +3.40 (+0.03 - 0.00) VDC. | | |
| 6.2.19.8 | | |
| Initiate CMC Self Check by inserting the following into K148: | | |
| a. ERROR RESET | | |
| b. VERB 21 NOUN 27, ENTER | | |
| c. 77777, ENTER | | |
| Wait 200 seconds | | |
| 6.2.19.9 | | |
| Insure that the DSKY RESTART lamp and Program Alarm lamp does not light. | | |
| 6.2.19.10 | | |
| Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify the RESTART lamp on the DSKY is lighted. Disregard other DSKY indications. If RESTART does not light, repeat 6.2.19.3. Verify CMC Warning masters alarm are lighted. | | |
| 6.2.19.11 | | |
| Set the INHIBIT VOLTAGE FAIL switch to ON. Insert the following into K148: | | |
| a. ERROR RESET | | |
| b. VERB 21 NOUN 27, ENTER | | |
| c. 77777, ENTER | | |
| 6.2.19.12 | | |
| Into R154 insert 0001. Verify and execute. | | |
| 6.2.19.13 | | |
| Into C156 insert +106001244. Verify and execute. Verify on the CRT that GV0116 is between +0.8 and +11.8 VDC. | | |
| 6.2.19.14 | | |
| Into R154 insert 0111. Verify and execute. | | |
| 6.2.19.15 | | |
| Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.12 through 6.2.19.14 adjusting the C-Start entry until CG 1020 is 16.4 (+0.0, -0.1) VDC. | | |
| 6.2.19.16 | | |
| Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light. | | |
| 6.2.19.17 | | |
| Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted. | | |

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- 6.2.19.18 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to ON. Into K148 insert:
- ERROR RESET
 - VERB 21 NOUN 27, ENTER
 - 77777, ENTER
- 6.2.19.19 Into R154 insert 0001. Verify and execute.
- 6.2.19.20 Into C156 enter +092001234. Verify and execute. Verify on the CRT that GV0106 is between +8.2 and +10.2 VDC.
- 6.2.19.21 Into R156 insert 0111. Verify and execute.
- 6.2.19.22 Observe CG 1030. +4 VDC CMC Power Supply on the CRT. Repeat 6.2.19.19 through 6.2.19.21 adjusting the C-Start entry until CG 1030 is +4.60 (+0.00, -0.03) VDC.
- 6.2.19.23 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.24 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Verify CMC Warning master alarms are lighted.
- 6.2.19.25 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to ON. Into K148 insert:
- ERROR RESET
 - VERB 21 NOUN 27, ENTER
 - 77777, ENTER
- 6.2.19.26 Into R154 insert 0001. Verify and execute
- 6.2.19.27 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.28 Into R154 insert 0111. Verify and execute.
- 6.2.19.29 Observe CG 1020. +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.26 through 6.2.19.28 adjusting the C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC.
- 6.2.19.30 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.

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| 6.2.19.31 | Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted. | | |
| 6.2.19.32 | Into R154 insert 0000. Verify and execute. | | |
| 6.2.19.33 | Terminate CMC Self-Check by inserting into K148. | | |
| | a. ERROR RESET | | |
| | b. VERB 21, NOUN 27, ENTER | | |
| | c. 00000, ENTER | | |
| 6.2.19.34 | Ensure that CG 1020, +14 VDC CMC Power Supply indication, is +14.0±0.4 and that CG 1030, +4 VDC CMC Power Supply indication is +4.00±0.20 VDC on the CRT. | | |



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- 6.2.20 Spacecraft Control and Displays Test.
- 6.2.20.1 Proceed with this test if the Operate Power On Test of 6.2.3 and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2 before proceeding.
- 6.2.20.2 FDAI Attitude Error.
- 6.2.20.2.1 Insert in K148
- V92 ENTER
 - 00013 ENTER
- 6.2.20.2.2 Observe on CRT
- VO6 NO1 Flashing
 - PROG 07
 - NO ATT ON
 - R1, R2, and R3 Approx. 00000
- 6.2.20.2.3 Insert in K148
- VERB 33, ENTER
- 6.2.20.2.4 Observe on CRT
- VO6 N 01 Flashing
 - R1 +00385
 - R2 -00385
 - R3 +00385
 - NO ATT OFF
- 6.2.20.2.5 Record CRT indications
- CG 2279 ROLL ATT ERROR - CDU DAC OUT +5.06±0.50V rms, press
 - CG 2219 PITCH ATT ERROR - CDU DAC OUT -5.06±0.50V rms, press
 - CG 2249 YAW ATT ERROR - CDU DAC OUT +5.06±0.50V rms, press
- 6.2.20.2.6 Insert in K148
- VERB 33, ENTER
- 6.2.20.2.7 Observe on CRT
- VO6 NO1 Flashing
 - R1 +00384
 - R2 -00384
 - R3 +00384

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| 6.2.20.2.8 | | |
| Record CRT indications | | |
| a. CG 2279 | ROLL ATT ERROR - CDU DAC OUT | +5.06±0.50V rms _{peak} |
| b. CG 2219 | PITCH ATT ERROR - CDU DAC OUT | -5.06±0.50V rms _{peak} |
| c. CG 2249 | YAW ATT ERROR - CDU DAC OUT | +5.06±0.50V rms _{peak} |
| 6.2.20.2.9 | | |
| Insert in K148 | | |
| a. | VERB 33, ENTER | |
| 6.2.20.2.10 | | |
| Observe on CRT | | |
| a. VO6 | N01 | Flashing |
| b. R1 | | +00160 |
| c. R2 | | -00160 |
| d. R3 | | +00160 |
| 6.2.20.2.11 | | |
| Record CRT indications | | |
| a. CG 2279 | ROLL ATT ERROR - CDU DAC OUT | +2.11±0.21V rms _{peak} |
| b. CG 2219 | PITCH ATT ERROR - CDU DAC OUT | -2.11±0.21V rms _{peak} |
| c. CG 2249 | YAW ATT ERROR - CDU DAC OUT | +2.11±0.21V rms _{peak} |
| 6.2.20.2.12 | | |
| Insert in K148 | | |
| a. | VERB 33, ENTER | |
| 6.2.20.2.13 | | |
| Observe on CRT | | |
| a. VO6 | N01 | Flashing |
| b. R1 | | +00135 |
| c. R2 | | -00135 |
| d. R3 | | +00135 |
| 6.2.20.2.14 | | |
| Record CRT indications | | |
| a. CG 2279 | ROLL ATT ERROR - CDU DAC OUT | +1.78±0.18V rms _{peak} |
| b. CG 2219 | PITCH ATT ERROR - CDU DAC OUT | -1.78±0.18V rms _{peak} |
| c. CG 2249 | YAW ATT ERROR - CDU DAC OUT | +1.78±0.18V rms _{peak} |
| 6.2.20.2.15 | | |
| Insert in K148 | | |
| a. | VERB 33, ENTER | |
| 6.2.20.2.16 | | |
| Observe on CRT | | |
| a. VO6 | N01 | Flashing |
| b. R1 | | +00090 |
| c. R2 | | -00090 |
| d. R3 | | +00090 |

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- 6.2.20.2.17 Record CRT indications.
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $+1.19 \pm 0.12V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $-1.19 \pm 0.12V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $+1.19 \pm 0.12V$ rms
- 6.2.20.2.18 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.19 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 +00000
 - c. R2 +00000
 - d. R3 -00090
- 6.2.20.2.20 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $0.00 \pm 0.06V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $0.00 \pm 0.06V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $-1.19 \pm 0.12V$ rms
- 6.2.20.2.21 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.22 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 -00090
 - c. R2 +00090
 - d. R3 -00135
- 6.2.20.2.23 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $-1.19 \pm 0.12V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+1.19 \pm 0.12V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $-1.79 \pm 0.16V$ rms
- 6.2.20.2.24 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.25 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 -00135
 - c. R2 +00135
 - d. R3 -00160

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- 6.2.20.2.26 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $-1.78 \pm 0.18V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+1.78 \pm 0.18V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $-2.11 \pm 0.21V$ rms
- 6.2.20.2.27 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.28 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 -00160
 - c. R2 +00160
 - d. R3 -00384
- 6.2.20.2.29 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $-2.11 \pm 0.21V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+2.11 \pm 0.21V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $-5.06 \pm 0.50V$ rms
- 6.2.20.2.30 Insert K148
- a. VERB 33, ENTER
- 6.2.20.2.31 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 -00384
 - c. R2 +00384
 - d. R3 -00385
- 6.2.20.2.32 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $-5.06 \pm 0.50V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+5.06 \pm 0.50V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $-5.06 \pm 0.50V$ rms
- 6.2.20.2.33 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.34 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 -00385
 - c. R2 +00385
 - d. R3 +00000

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- 6.2.20.2.35 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $-5.06 \pm 0.50V$ rms gross
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+5.06 \pm 0.50V$ rms gross
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $0.00 \pm 0.06V$ rms gross
- 6.2.20.2.36 Insert in K148
- a. V21 NO1 ENTER
 - b. 02545 ENTER
 - c. 03302 ENTER
 - d. V33 ENTER
- 6.2.20.2.37 Observe on CRT
- a. V06 NO3 Flashing
 - b. NO ATT ON
 - c. R1 +00000 approximately
 - d. R2 +00000 approximately
 - e. R3 +00000 approximately

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| 6.2.20.3 | TVC Test | |
| 6.2.20.3.1 | The G/N Autopilot Control and SPS Ready discretes shall be applied to the G/N Interface. | |
| 6.2.20.3.2 | Set the OPTICS MODE selector on the Indicator Control Panel to MAN. | |
| 6.2.20.3.3 | Insert in K148 a. VERB 33, ENTER | |
| 6.2.20.3.4 | Observe on CRT a. V 01 N10 Flashing b. R1 X7373 c. R3 00030 | |
| 6.2.20.3.5 | Insert in K148 a. V 33 ENTER | |
| 6.2.20.3.6 | Observe on CRT a. V 01 Noun 10 Flashing b. R1 37777 c. R3 00031 | |
| 6.2.20.3.7 | Insert in K148 a. V 33 ENTER | |
| 6.2.20.3.8 | Observe on CRT a. V06 NO3 Flashing b. R1 +00385 c. R2 -00385 d. R3 +00003 | |
| 6.2.20.3.9 | Record CRT indications a. CG 3722 TRUNNION CDU DAC OUTPUT +10.12±1.00V rms b. CG 3721 SHAFT CDU DAC OUTPUT -10.12±1.00V rms | |
| 6.2.20.3.10 | Insert in K148 a. VERB 33, ENTER | |

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| 6.2.20.3.11 | Observe on CRT | |
| a. VO6 N 03 | Flashing | |
| b. R1 | +00384 | |
| c. R2 | -00384 | |
| d. R3 | +00003 | |
| e. NO ATT | OFF | |
| 6.2.20.3.12 | Record CRT indications | |
| a. CG 3722 TRUNNION CDU DAC OUTPUT | +10.12±1.00V rms | |
| b. CG 3721 SHAFT CDU DAC OUTPUT | -10.12±1.00V rms | |
| 6.2.20.3.13 | Insert in K148 | |
| a. VERB 33, ENTER | | |
| 6.2.20.3.14 | Observe on CRT | |
| a. VO6 N 03 | Flashing | |
| b. R1 | +00160 | |
| c. R2 | -00160 | |
| d. R3 | +00003 | |
| 6.2.20.3.15 | Record CRT indications | |
| a. CG 3722 TRUNNION CDU DAC OUTPUT | +4.22±0.42V rms | |
| b. CG 3721 SHAFT CDU DAC OUTPUT | -4.22±0.42V rms | |
| 6.2.20.3.16 | Insert in K148 | |
| a. VERB 33 ENTER | | |
| 6.2.20.3.17 | Observe on CRT | |
| a. VO6 N 03 | Flashing | |
| b. R1 | +00135 | |
| c. R2 | -00135 | |
| d. R3 | +00003 | |
| 6.2.20.3.18 | Record CRT indications | |
| a. CG 3722 TRUNNION CDU DAC OUTPUT | +3.56±0.36V rms | |
| b. CG 3721 SHAFT CDU DAC OUTPUT | -3.56±0.36V rms | |
| 6.2.20.3.19 | Insert in K148 | |
| a. VERB 33 ENTER | | |

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- 6.2.20.3.20 Observe on CRT
- a. VO6 N 03 Flashing
 - b. R1 +00090
 - c. R2 -00090
 - d. R3 +00003
- 6.2.20.3.21 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT $+2.38 \pm 0.24V$ rms rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT $-2.38 \pm 0.24V$ rms rms
- 6.2.20.3.22 Set the OPTICS CONTROLLER SPEED Switch on the Indicator Control panel to HI.
- 6.2.20.2.23 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.24 Observe on CRT
- a. VO6 N 03 Flashing
 - b. R1 +00000
 - c. R2 +00000
 - d. R3 +00003
- 6.2.20.3.25 While holding the Optics Hand Controller up and left (45°) no longer than 10 seconds, record CRT indications.
- a. CG 3722 TRUNNION CDU DAC OUTPUT $0.00 \pm 0.12V$ rms rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT $0.00 \pm 0.12V$ rms rms
- 6.2.20.3.26 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.27 Observe on CRT
- a. VO6 N 03 Flashing
 - b. R1 -00090
 - d. R2 +00090
 - d. R3 +00003
- 6.2.20.3.28 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT $-2.38 \pm 0.24V$ rms rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT $+2.38 \pm 0.24V$ rms rms

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- 6.2.20.3.29 Set the OPTICS MODE Switch on the Indicator Control Panel to ZERO for 30 seconds, then return to MAN.
- 6.2.20.3.30 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.31 Observe on CRT
- a. VO6 N 03 Flashing
- b. R1 -00135
- c. R2 +00135
- d. R3 +00003
- 6.2.20.3.32 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -3.56±0.36V rms rms
- b. CG 3721 SHAFT CDU DAC OUTPUT +3.56±0.36V rms rms
- 6.2.20.3.33 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.34 Observe on CRT
- a. VO6 N 03 Flashing
- b. R1 -00160
- c. R2 +00160
- d. R3 +00003
- 6.2.20.3.35 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -4.22±0.42V rms rms
- b. CG 3721 SHAFT CDU DAC OUTPUT +4.22±0.42V rms rms
- 6.2.20.3.36 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.37 Observe on CRT
- a. VO6 N 03 Flashing
- b. R1 -00384
- c. R2 +00384
- d. R3 +00003

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6.2.20.3.38 Record CRT indications
a. CG 3722 TRUNNION CDU DAC OUTPUT -10.12±1.00V rms rms
b. CG 3721 SHAFT CDU DAC OUTPUT +10.12±1.00V rms rms

6.2.20.3.39 Insert in K148
a. VERB 33 ENTER

6.2.20.3.40 Observe on CRT
a. VO6 N 03 Flashing
b. R1 -00385
c. R2 +00385
d. R3 +00003

6.2.20.3.41 Record CRT indications
a. CG 3722 TRUNNION CDU DAC OUTPUT -10.12±1.00V rms rms
b. CG 3721 SHAFT CDU DAC OUTPUT +10.12±1.00V rms rms

6.2.20.3.42 Insert in K148
a. V 34 ENTER
b. V 40 N 20 ENTER
c. V 41 N 20 ENTER
d. +00000 ENTER
e. +00000 ENTER
f. +00000 ENTER

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APPENDIX I

| Signal | Link | Nomenclature | G&N Test Requirement | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|-----------------------------|--|--|
| CG 1020 | 1 | +14 VDC CMC SUPPLY | +14.0±0.4 VDC | 0% |
| CG 1030 | 1 | +4 VDC CMC SUPPLY | +4.00±0.2 VDC | 0% |
| CG 1040 | 2 | +120 VDC PIPA SUPPLY | +120±6.0 VDC | 1% |
| CG 1051 | 1 | +20 VDC PIPA SUPPLY | +20.0±1.2 VDC | 0% |
| CG 1052 | 1 | -20 VDC PIPA SUPPLY | -20±2 VDC | 0% |
| CG 1070 | 1 | +4 VDC CDU SUPPLY | +4.0±0.2 VDC | 0% |
| CG 1100 | 1 | -28 VDC SUPPLY | -27.5±6.0 VDC | 0% |
| CG 1110 | 2 | 2.5 VDC TM HIAS | +2.50±0.05 VDC | 0% |
| CG 1201 | 2 | IMU 28V .8KC 1% 0° RMS | 28.00±0.56 VRMS | 1% |
| CG 1202 | 1 | IMU 28V .8KC 5% - 90° RMS | 28.0±1.4 VRMS | 1.5% |
| CG 1203 | 1 | IMU 28V .8KC 0° RMS | 28.0±2.1 VRMS | 1.5% |
| CG 1207 | 1 | PH DIFF IMU 5% 0°, -90° | -90±10° | 3% |
| CG 1211 | 1 | OPTX 28V .8KC 1% 0° RMS | 28.00±0.56 VRMS | 1.5% |
| CG 1212 | 1 | OPTX 28V .8KC 5% - 90° RMS | 28.00±1.48 VRMS | 1.5% |
| CG 1220 | 1 | PH DIFF OPTX 1% IMU 1% | 0° ±10° | 3% |
| CG 1331 | 2 | 3.2 KC 28V SUPPLY | 28.6±0.56 VRMS | 1% |
| CG 1336 | 1 | PH DIFF 3.2 KC 28V/CMC SYNC | 0° ±10° | 3% |
| CG 1500 | 1 | +28 VDC IMU OPERATE BUS | 28.8±3 VDC | 0% |
| CG 1510 | 1 | +28 VDC IMU STANDBY BUS | 28.8±3 VDC | 0% |
| CG 1520 | 1 | +28 VDC CMC OPERATE BUS | 28.8±3 VDC | 0% |
| CG 1530 | 1 | +28 VDC OPTX OPERATE BUS | 28.8±3 VDC | 0% |
| CG 2001 | 2 | X PIPA SG O/P | 5 VRMS max | 3% |
| CG 2021 | 2 | Y PIPA SG O/P | 5 VRMS max | 3% |
| CG 2041 | 2 | Z PIPA SG O/P | 5 VRMS max | 3% |
| CG 2108 | 1 | IG SERVO ERROR QUAD | 0.0±1.2 VRMS | 3% |
| CG 2112 | 2 | IG 1X RESOLVER O/P SIN | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2113 | 2 | IG 1X RESOLVER O/P COS | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2117 | 2 | IG SERVO ERROR IN PHASE | 0.0±60 mv RMS @ null | 2% |
| CG 2120 | 1 | IG TORQUE MOTOR CURRENT | 0.125 amp max during Fine Alignment Torquing | 0% |
| CG 2138 | 1 | MG SERVO ERROR QUAD | 0.0±1.2 VRMS | 3% |
| CG 2142 | 2 | MG 1X RESOLVER O/P SIN | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2143 | 2 | MG 1X RESOLVER O/P COS | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2147 | 2 | MG SERVO ERROR IN PHASE | 0.0±60 mv rms @ null | 2% |
| CG 2150 | 1 | MG TORQUE MOTOR CURRENT | 0.125 amp max during Fine Align Torquing | 0% |
| CG 2168 | 1 | OG SERVO ERROR QUAD | 0.0±1.2 VRMS | 3% |
| CG 2172 | 2 | OG 1X RESOLVER O/P SIN | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2173 | 2 | OG 1X RESOLVER O/P COS | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2177 | 2 | OG SERVO ERROR IN PHASE | 0.0±60 mv RMS @ null | 2% |
| CG 2180 | 1 | OG TORQUE MOTOR CURRENT | 0.125 amp max during Fine Align Torquing | 0% |
| CG 2219 | 1 | PITCH ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS @ 17° | 2% |
| CG 2220 | 1 | IG CDU FINE ERROR | 0.0±0.7 VRMS @ null | 1% |

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| Signal | Link | Nomenclature | G&N Test Requirement | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|-----------------------------------|---------------------------|--|
| CG 2221 | 1 | IG CDU COARSE ERROR | 0.0±0.68 VRMS @ null | 1% |
| CG 2249 | 1 | YAW ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS @ 17° | 2% |
| CG 2250 | 1 | MG CDU FINE ERROR | 0.0±0.7 VRMS @ null | 1% |
| CG 2251 | 1 | MG CDU COARSE ERROR | 0.0±0.68 VRMS @ null | 1% |
| CG 2279 | 1 | ROLL ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS @ 17° | 2% |
| CG 2280 | 1 | OG CDU FINE ERROR | 0.0±0.07 VRMS @ null | 1% |
| CG 2781 | 1 | OG CDU COARSE ERROR | 0.0±0.68 VRMS | 1% |
| CG 2300 | 2 | PIPA TEMPERATURE | 130.5±1.5°F Operate Mode | 2% |
| CG3011 | 1 | TRUNNION CDU FINE ERROR | 0.0±0.07 VRMS @ null | 1% |
| CG 3021 | 1 | SHAFT CDU FINE ERROR | 0.0±0.07 VRMS @ null | 1% |
| CG 3117 | 1 | SXT SHAFT SERVO ERROR IN PH | 2 VRMS max | 2% |
| CG 3118 | 1 | SXT TRUNNION SERVO ERROR IN PHASE | 2 VRMS max | 2% |
| CG 3140 | 1 | SXT SHAFT TACH O/P | 3.3±1.3 VRMS @ Hi Rate | 2% |
| CG 3145 | 1 | SXT SHAFT MTR CONTROL WINDING | 3.3±1.3 VRMS @ Hi Rate | 2% |
| CG 3150 | 1 | SXT TRUNNION TACH O/P | 3.3±1.3 VRMS @ Hi Rate | 2% |
| CG 3155 | 1 | SXT TRUNNION MTR CONTROL WINDING | 0.85±0.35 VRMS at Hi Rate | 2% |
| CG 3160 | 1 | SCT SHAFT TACH O/P | 3.3±1.3 VRMS @ Hi Rate | 2% |
| CG 3170 | 1 | SCT TRUNNION TACH O/P | 0.85±0.35 VRMS @ Hi Rate | 2% |
| CG 3721 | 2 | SHAFT CDU DAC O/P | 10.12±1.00 VRMS @ 17° | 1% |
| CG 3722 | 2 | TRUNNION CDU DAC O/P | 10.12±1.00 VRMS @ 17° | 1% |
| CG 4300 | 1 | CMC TEMP | 87.5±42.5°F | 0% |
| CG 6020 | 1 | PIPA CAL MODULE TEMP | 72.5±27.5°F | 0% |
| CG 6021 | 1 | IMU 800 cps 5% TEMP (PSA) | 90±30°F | 0% |
| CG 2301 | 1 | IRIG TEMPERATURE | 135±2.5°F in Operate | 2% |
| CG 1021 | 1 | +14V CMC SUPPLY NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1031 | 1 | +4V CMC SUPPLY NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1042 | 1 | +120 VDC PIPA SUP NOISE RMS | 1.5 VRMS MAX | 0% |
| CG 1053 | 1 | +20 VDC PIPA SUP NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1071 | 1 | +4 VDC CDU SUP NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1501 | 1 | +28V IMU OPERATE BUS NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1511 | 1 | +28V IMU STANDBY BUS NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1521 | 1 | +28V CMC OPERATE BUS NOISE RMS | 2.0 VRMS MAX | 0% |
| CG 1531 | 1 | +28V OPTX OPERATE BUS NOISE RMS | 2.0 VRMS MAX | 0% |

PSAAM OUTPUT is the source of Link 1 signals. SCA OUTPUT is the source of Link 2 signals.

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ADDENDUM I

SCOPE: The following changes are required to make ND1002348 applicable as a G&N System Technical support document for MSO Testing.

Change 1. Add paragraph 6.1.2 through 6.1.2.1.4.1 as follows:

- 6.1.2 The following optical reference alignment requirements shall be demonstrated.
- 6.1.2.1 G&N Installation Qualification Fixture.
- 6.1.2.1.1 The SXT Optical Reference No. 1 (Azimuth Autoset) LOS shall be located approximately 40 degrees (CW when viewed from above) from the SCZ axis measured in a horizontal plane. At this position, the Optical Reference shall be capable of being viewed through the SXT ST LOS.
- 6.1.2.1.2 The SXT Optical Reference LOS position with respect to the horizontal plane shall be known to within 5 arc-seconds. The azimuth bearing of the Optical Reference LOS shall be known to within ± 30 minutes of arc.
- 6.1.2.1.3 The SXT Optical Reference No. 2 LOS shall be located approximately 80 degrees from the SXT Optical Reference No. 1 (40 degrees from S/C Z axis) measured in a horizontal plane. At this position, the Optical Reference shall be capable of being viewed through the SXT STAR LOS.
- 6.1.2.1.3.1 The SXT optical reference LOS position with respect to the horizontal plane shall be known to within 5 arc-seconds. The azimuth bearing of the Optical Reference LOS shall be known to within ± 30 minutes of arc.
- 6.1.2.1.4 SXT Optical Reference No. 3 shall be capable of being viewed through the SXT LLOS and the STAR LOS simultaneously at the Zero Optics position.
- 6.1.2.1.4.1 SXT Optical Reference No. 3 shall have the capability to measure the nonparallelism of the LLOS and STAR LOS to a resolution of 2 arc-seconds.

Change 2. Delete paragraphs 6.2.12 through 6.2.12.9.13 and replace with the following:

- 6.2.12 Optics Function Test - MSO
- 6.2.12.1 Proceed with this test if 6.2.3, Operate Power On Test, or 6.2.5.2, Turn-On Procedure has been performed and system operation has not been interrupted. Set Tracker switch to OFF. If system operation has been interrupted perform 6.2.5.2, Turn On Procedure, before proceeding. This test requires the use of the G&N Installation Qualification Fixture A23-097 mounted on the Optics Supporting Fixture A14-135. Insure that the qualification fixture has been properly aligned and that both Autosets are visible through the SXT SLOS before proceeding. Insure that lamp power is available to the qualification fixture and to the Portable Lamp Assembly.

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| 6.2.12.2 | | |
| Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following: | | |
| a. +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8±3 VDC. Record the indication on the CRT. | | |
| b. CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT. | | |
| c. CG 1212 OPTX 800 cps 5% - 90 ph not flashing on CRT. | | |
| 6.2.12.3 | | |
| Deleted | | |
| 6.2.12.4 | | |
| Insure that the Optics control switches on the G&N Indicator Control Panel are set as follows: | | |
| a. OPTICS MODE to MAN | | |
| b. CONTROLLER SPEED to LO | | |
| c. CONTROLLER COUPLING to DIRECT | | |
| d. TELESCOPE TRUNNION to SLAVE to SXT | | |
| 6.2.12.5 | | |
| Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN. | | |
| 6.2.12.6 | | |
| Resolution Checks. | | |
| 6.2.12.6.1 | | |
| Sight through the SXT eyepiece. Using the OPTICS CONTROL STICK, adjust the SXT to obtain the best reflected field of view of the 5-Inch autocollimator reticle engravings at the center of the field of view. | | |
| 6.2.12.6.2 | | |
| Note that the autocollimator reticle contains a series of lines of different thickness and width. Each set of lines is marked with a number (20, 15, 10, 7, 5, 3) which indicates the angle subtended by one line and one space. View each set of lines to determine the lowest numbered set in which resolution between lines (ability to distinguish separate distinct lines within a set) can be made. Record the number associated with that set of lines. The SXT resolution shall be at least 10 arc seconds at the center of the field of view. | | |
| 6.2.12.6.3 | | |
| Repeat 6.2.12.6.1 and 6.2.12.6.2 using the SCT and the SCT resolution chart. The SCT shall have a resolution of at least 3 arc minutes at the center of the field of view. | | |
| 6.2.12.7 | | |
| Slave Telescope Mode Checks | | |
| 6.2.12.7.1 | | |
| Verify/Perform OPTICS POWER ON TEST per Paragraph 6.2.3.2. | | |
| 6.2.12.7.2 | | |
| Set/Verify following switches on G&N INDICATOR CONTROL PANEL: | | |
| TELESCOPE TRUNNION - SLAVE to SXT | | |
| CONTROLLER COUPLING - DIRECT | | |
| CONTROLLER SPEED - HI | | |

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| 6.2.12.7.3 | Monitor OCDU's by entering VERB 16 NOUN 55 into K-148. Press ENTER. |
| 6.2.12.7.4 | Set OPTICS MODE to MAN. |
| 6.2.12.7.5 | Using the Optics Hand Controller drive the optics until: R1 = +010.00±001.00 (SHAFT) R2 = +10.000±01.000 (TRUNNION) |
| 6.2.12.7.6 | Verify on CRT and OPTICS PANEL SHAFT TPAC = R1 ±0.11° TRUNNION TPAC = R2 ±0.22° |
| 6.2.12.7.7 | Set the TELESCOPE TRUNNION on the G&N INDICATOR PANEL to 0°. |
| 6.2.12.7.8 | Verify: SHAFT TPAC = R1 ±0.11° TRUNNION TPAC = 0.0° ±0.22° R2 approximately equal to value specified in 6.2.12.7.5. |
| 6.2.12.7.9 | Set the TELESCOPE TRUNNION ON THE G&N INDICATOR CONTROL PANEL to OFFSET 25°. |
| 6.2.12.7.10 | Verify on the CRT and Optics Panel: SHAFT TPAC = R1 ±0.11 Deg. TRUN TPAC = 25° ±0.22 Deg. R2 approximately equal to value specified in 6.2.12.7.5. |
| 6.2.12.7.11 | On the G&N Indicator Control Panel set the TELESCOPE TRUNNION to SLAVE to SXT. |
| 6.2.12.7.12 | Verify on CRT and Optics Panel: SHAFT TPAC = R1 ±0.11 Deg. TRUN TPAC = R2 ±0.22 Deg. |
| 6.2.12.7.13 | On the G&N Indicator Control Panel set the OPTICS MODE to ZERO. Wait 15 sec. |
| 6.2.12.7.14 | Verify on CRT and OPTICS PANEL: R1 = 000.00+000.02, -000.03 R2 = 00.000+00.006, -00.007 |

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- 6.2.12.8.10 Remove the Portable Light Assembly and Adapter Assembly from the base of the SXT eyepiece. Replace the SXT eyepiece plug.
- NOTE: If Optics testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.9 SXT, CMC Function Check.
- 6.2.12.9.1 Set the OPTICS MODE switch to ZERO. After 15 seconds, return the switch to MAN.
- 6.2.12.9.2 Sight through the SXT. Using the Control Stick align the SXT StLOS with optical target no. 1. When aligned press MARK.
- 6.2.12.9.3 Record the value of R1 and R2 displayed on the CRT. Record the Shaft and Trunnion angles from the TPAC.
- 6.2.12.9.4 Sight through the SXT. Using the Control Stick align the SXT StLOS with Optical Target No. 2. When aligned press MARK.
- 6.2.12.9.5 Record the value in R1 and R2 on the DSKY. Record the Shaft and Trunnion angles from TPAC.
- 6.2.12.9.6 Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. After 15 seconds set the switch to MAN, then CMC.
- 6.2.12.9.7 Enter VERB 41, NOUN 55, ENTER into the DSKY. Enter the value for R1 from 6.2.12.9.3 into the DSKY and press ENTER. Enter the value for R2 from 6.2.12.9.3 into the DSKY and press ENTER.
- 6.2.12.9.8 Sight through the SXT. The StLOS should be approximately centered on Optical Target No. 1. Record the Shaft and Trunnion angles from the TPAC. The difference between these values and the corresponding values recorded in 6.2.12.9.3 shall be less than 0.25 degrees. Record the difference.
- 6.2.12.9.9 Enter VERB 41, NOUN 55, ENTER into the DSKY. Enter the value for R1 from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton. Enter the value for R2 from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton.
- 6.2.12.9.10 Sight through the SXT. The StLOS should be approximately centered on Optical Target No. 2. Record the Shaft and Trunnion angles from the TPAC. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.25 degrees. Record the difference.
- 6.2.12.9.11 Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN.

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| 6.2.12.9.12 | | |
| If OPTICS Testing will not continue, set the G&N Power-Optics switch on the LEB Lighting Panel to OFF. | | |

APOLLO G&N Specification
 ND 1002346 C
 Original Issue Date: 17 Feb 67
 Release Authority: TDRR 33027
 Class 4 Release

POST INSTALLATION CHECKOUT PROCESS
 SPECIFICATION FOR THE APOLLO GUIDANCE &
 NAVIGATION SYSTEM BLOCK II-KSC

Record of Revisions

| Date | Revision Letter | TDRR No. | Pages Revised | Approvals |
|---------|-----------------|----------|---|-----------|
| 5/11/67 | A | 33750 | 10-12, 15, 24, 35-46, 51-56, 58-67, 73-78, 81, 82, 84-86, 91, 95-97, 99-102, 105-119. Was 119 pages, now 120. <i>9/1/67</i> | EA |
| 9/29/67 | B | 34782 | 2-128; Specification was 128 pages, now 129 <i>9/29/67</i> | EA |
| 1/16/68 | C | 35445 | Completely revised. Specification was 129 pages, now 174 pages. <i>1/16/68</i> | EA |
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This specification consists of page 1 to 174 inclusive.

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| APPROVALS | NASA/MSC | <i>[Signature]</i> | <i>[Signature]</i> | <i>[Signature]</i> |
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1. INTRODUCTION

1.1 The individual Spacecraft (SC) installed Guidance and Navigation (G&N) System to be checked out per this process specification shall consist of one of each of the following major assemblies: The applicable part numbers shall be determined by drawing No. 2014999.

- 1 - Optical Unit Assembly
- 1 - Navigation Base Assembly, Block II
- 1 - Inertial Measurement Unit (IMU) & PIPA Elect. Assy.
- 1 - Power and Servo Assembly (PSA)
- 1 - Apollo Guidance Computer Group
- 1 - G&N Interconnect Harness Assembly
- 1 - Signal Conditioner Assembly
- 1 - Display and Control Group (D & C)
- 1 - Coupling Data Unit

1.2 The G&N System herein shall be identified as a Block II system. The computer contains the program flight ropes in the core rope memory. The test requirements herein are based on Sundisk Rev. 287.

2. COPE

2.1 This specification outlines the checkout requirements for the G&N System installed in the Apollo Command Module Spacecrafts and tested in the VAB or on the PAD.

2.2 This document is to be used as technical support for all Block II G&N System test documentation for Command Module spacecraft testing. This document shall be amended by addendum to support applicable hardware, mission or program differences.

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3. APPLICABLE DOCUMENT

3.1 Documents Required by this Specification

3.1.1 When the requirements of this specification conflict with the drawing requirements, the drawing requirements shall have precedence.

| | |
|---------------------|---|
| PS 2015000 | Master End Item Specification, Part II, Product Configuration and Acceptance Test Requirements, G&N Spacecraft Equipment Command Module, Block II |
| ICD MH01-01307-216 | CDU to TVC Servo Amps Electrical Block II |
| ICD MH01-01324-216 | Attitude Error Signals Electrical Block II |
| ICB MH 01-01325-216 | Total Attitude Signals |
| ICD MH01-01327-216 | G&N Electrical Input Power |
| ICD MH01-01328-216 | G&N Data Transmission to Operational and Flight Qual. Telemetry |
| ICB MH01-01342-216 | G&N System Caution and Warning System Interface |
| ICD MH01-01349-416 | G&N Thermal Requirements for Block II AGE |
| ICD MH01-01344-216 | Mode Control Signals S/C to ISS Discretes |
| ICD MH01-01335-200 | Electrical Inertial Temperature Controller |
| ICD MH01-01380-216 | Command Module Guidance Computer Electrical Interfaces Block II |
| ICD MH01-01386-216 | Attitude Error to SIVB |
| MH01-01390-200 | G&N PSA Adapter Module ACE-S/C DTMS and DTCS Block II Vehicles. |
| MA0201 | ACE-S/C Computer Subprogram Program Requirements S/C 101 KSC |
| MA0308-0107 | Mechanical Installation Specification for Apollo Guidance Equipment |
| MA0610-018A | Contamination Control-Apollo Command Module and Service Module |
| SID 65-1642 | Apollo Command Module/Service Module Measurement Requirements for Block II |

3.1.2 The following addendums are applicable to this document.

- Deleted
- Addendum II, Colossus G&N System Tests
- Addendum III, CSM 101.

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4.0 MATERIAL AND EQUIPMENT

4.1 The following test equipment shall be used to perform the requirements of this specification. If protection to personnel and equipment is not decreased, items, except government furnished parts, equivalent to those listed may be used.

| ITEM | QUANTITY | DESCRIPTION |
|------|----------|--|
| 1 | 1 | Digital Test Measurement System Model No. C14-208 |
| 2 | 1 | Digital Test Command System, Model No. C14-207 |
| 3 | 1 | Data Interleaver System, Model No. C14-232 |
| 4 | 1 | External Digital Test Command Unit Model No. C14-231 |
| 5 | 1 | S/C Ground Power Supply Model No. C14-418 |
| 6 | 1 | Breakout Box, Test, CM-SM Adapter Model No. C14-467 |
| 7 | 1 | Electrical Cable Set Model No. C34-391. |
| 8 | 1 | ICTC 513-100 MODEL 513-100 (MSO only) |
| 9 | 1 | PSA Adapter Module, Model No. A23-304 |
| 10 | 1 | OPTICS SUPPORTING FIXTURE MODEL A14-135 (MSO only) |
| 11 | 1 | G&N INSTALLATION QUALIFICATION FIXTURE MODEL NO. A23-097 (MSO only) |
| 12 | 1 | Theodolite (DKM 3 or equivalent) Model No. A23-079). |
| 13 | 1 | Retroreflecting Prism, Model No. A23-200 |
| 14 | 1 | Portable Light Assembly Model No. A23-196 |
| 15 | 1 | Vacuum Tube Volt Ohmmeter (VTVM) |
| 16 | 1 | Calculator (Friden or equivalent) |
| 17 | 1 | Movable Optics Target |
| 18 | 1 | SCT Resolution Check Card |
| 19 | 1 | Electrical Cable Portable G&N System, Model No. C14-462 |
| 20 | 1 | Electronic Counter with Preset Counter (Hewlett Packard 5245L with 526A Preset Plug-In Unit, or equivalent). |
| 21 | 1 | Cable Set, SMD9-17166 |

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SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ND1002348C 5

CODE IDENT. NO. 03953

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| ITEM | QUANTITY | DESCRIPTION |
|------|----------|---|
| 22 | 1 | Cable Set SMD9-17167 |
| 23 | 1 | Test Box, SMD9-17003 |
| 24 | | PORTABLE TEMPERATURE CONTROLLER MODEL NO. S23-011 (V.A.B & PAD ONLY) |
| 25 | | WHEATSTONE BRIDGE |
| 26 | 1 | Temperature Potentiometer LAN #8693 |

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5.0 GENERAL REQUIREMENTS

5.1 Safety Requirements

5.1.1 Operator Safety

5.1.1.1 Normal Safety precautions shall be observed throughout the G&N post-installation checkout.

5.1.2 Equipment Safety

5.1.2.1 To preserve the operational life of the components of the G&N Hardware under test, settings and adjustments shall be performed only when specified in the test procedure. Care shall be exercised in the accomplishment of all settings and adjustments to avoid excessive wear or damage to the equipment. All precautionary measures stated throughout the test procedures shall be strictly adhered to.

5.1.2.2 In no event shall the Inertial Components Temperature Controller (ICTC) be disconnected from connector 45J2 of the PSA except when specified to do so in a specific test.

5.1.2.3 The generation of noise alarm indication, as evidenced by one or more Noise Peak Event lights becoming lighted, shall be cause for immediate determination of effects on the G&N System Test in progress. In the event of detrimental effects on the system test, trouble shooting procedures shall be initiated to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

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- 5.1.2.4 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N System as nonconforming. The normal test sequence may be continued on determination of the cause of the nonconformance if not detrimental to the G&N System or other interfacing subsystems. This determination shall have the concurrence of the G&N contractor test team. All nonconformance shall be investigated and cleared by waiver (FNN), correction of test specification, or hardware replacement. The suspected malfunctioning hardware shall be removed and returned to the laboratory. Only a flight certified replaceable unit shall be installed in the G&N System.
- 5.1.2.5 The G&N System shall be operating in STANDBY mode with CMC power applied for a minimum of two hours prior to torquing of inertial components. In the event STANDBY or CMC power is interrupted, an equivalent time period shall be allowed when power is restored before transfer to the OPERATE mode, except that when the interval of interruption exceeds two hours, a two-hour warmup period shall be mandatory. Exceptions to the above are noted in 6.2.5.2.
- 5.1.2.6 The interruption of +28 VDC power to the G&N System through the Main A and Main B power busses shall be cause for the Command Module G&N System operator to immediately initiate the Emergency shutdown procedure (6.1.4) to preclude damage to the G&N System.
- 5.1.2.7 The SCT and SXT eyepieces shall be stowed whenever the instruments are not in use to preclude damage to them. It shall be necessary to install the eyepieces when testing requires use of the instrument.
- 5.1.2.8 To preserve the operational life of the components of the MDC and LEB DSKY's, the monitor routines shall be used only when required by test procedure or trouble shooting. Such routines shall be terminated as quickly as possible in the test flow. Computer routines which cause the DSKY display to flash (either requesting data or displaying data) shall also be terminated as quickly as possible.
- 5.1.2.9 To reduce the possibility of the optics drifting into the stops, place the Speed optics in the ZERO mode whenever the optics is to be on and not used for any appreciable time.
- 5.1.2.10 Avoid repeated slewing of SXT Shaft and Trunnion into the mechanical stops.

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| 5.2 | Standard Environmental Conditions | | | | | |
| 5.2.1 | The G&N System when installed in the Command Module shall be tested in an environment in accordance with ICD MH01-1348-416. At no time shall the dust particle count exceed Level 3000,000 of Federal Standard 209 with no more than 2,000 particles per cubic foot larger than 5 microns; no more than 35 particles larger than 65 microns with no more than 3 of these 35 larger than 100 microns in existence. Dust covers shall be installed on the SXT and SCT per KD MH01-01350-116 when optics are not under test. | | | | | |
| 5.2.1.1 | For periods of G&N Testing with the optical heads and the eyepieces of the SCT and SXT of the C/M G&N uncovered, or with the eyepieces removed, the environment shall meet at least the Class 100,000 particle size and count. | | | | | |
| 5.2.1.2 | With the optical heads covered and the eyepieces installed or covered on the optical components (SXT, SCT), the ambient environment shall meet the following conditions for particle size and count. No more than 1,400 particles 5.0 microns or larger per cubic foot. | | | | | |
| 5.2.2 | The APOLLO G&N System shall interface with a qualified ECS distribution system which shall supply coolant fluid during STANDBY and OPERATE control modes with flow rates and inlet temperatures as specified in ICD MH01-01349-416. | | | | | |
| 5.3 | Test Equipment Tolerances | | | | | |
| 5.3.1 | Measurements and tolerances are specifications stated herein are basic G&N System performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. Final tolerances must include PSAAM and Signal Conditioner stability uncertainties (see appendix 1) as well as ACE and ACE carry-on conditioning uncertainties. | | | | | |

5.4 Test Sequence

5.4.1 The test sequence should follow the flow chart of Figure 1, except for 6.2.5, Turn-On and Turn-Off procedure, which may be performed as the requirement arises.

TABLE I

| <u>Paragraph No.</u> | <u>Test Title</u> |
|----------------------|---|
| 6.2.1 | Application of Standby Power to G&N System |
| 6.2.2 | CMC Operational Test |
| 6.2.3 | Operate Power On Test |
| 6.2.4 | G&N Power Supplies Test |
| 6.2.5 | General Turn Off and Turn On Procedures |
| 6.2.6 | G&N Operational Test |
| 6.2.7 | Gimbal Friction Test |
| 6.2.8 | G&N Panel Brightness & Lamp Test |
| 6.2.9 | Semi-Automatic Mode Control Test |
| 6.2.10 | Zero Optics Test |
| 6.2.11 | Optics Coordinate Transformation Control Test |
| 6.2.12 | Optics Function Test - VAB and PAD |
| 6.2.13 | Optics Slew Rate Test |
| 6.2.14 | Stabilization Loop Step Response Test |
| 6.2.15 | IRIG Scale Factor Test |
| 6.2.16 | IMU Performance Test |
| 6.2.17 | Fine Alignment Test SXT-NB-IMU |
| 6.2.18 | Gyrocompassing Test |
| 6.2.19 | Voltage Margin Test |
| 6.2.20 | S/C Control & Display Test |

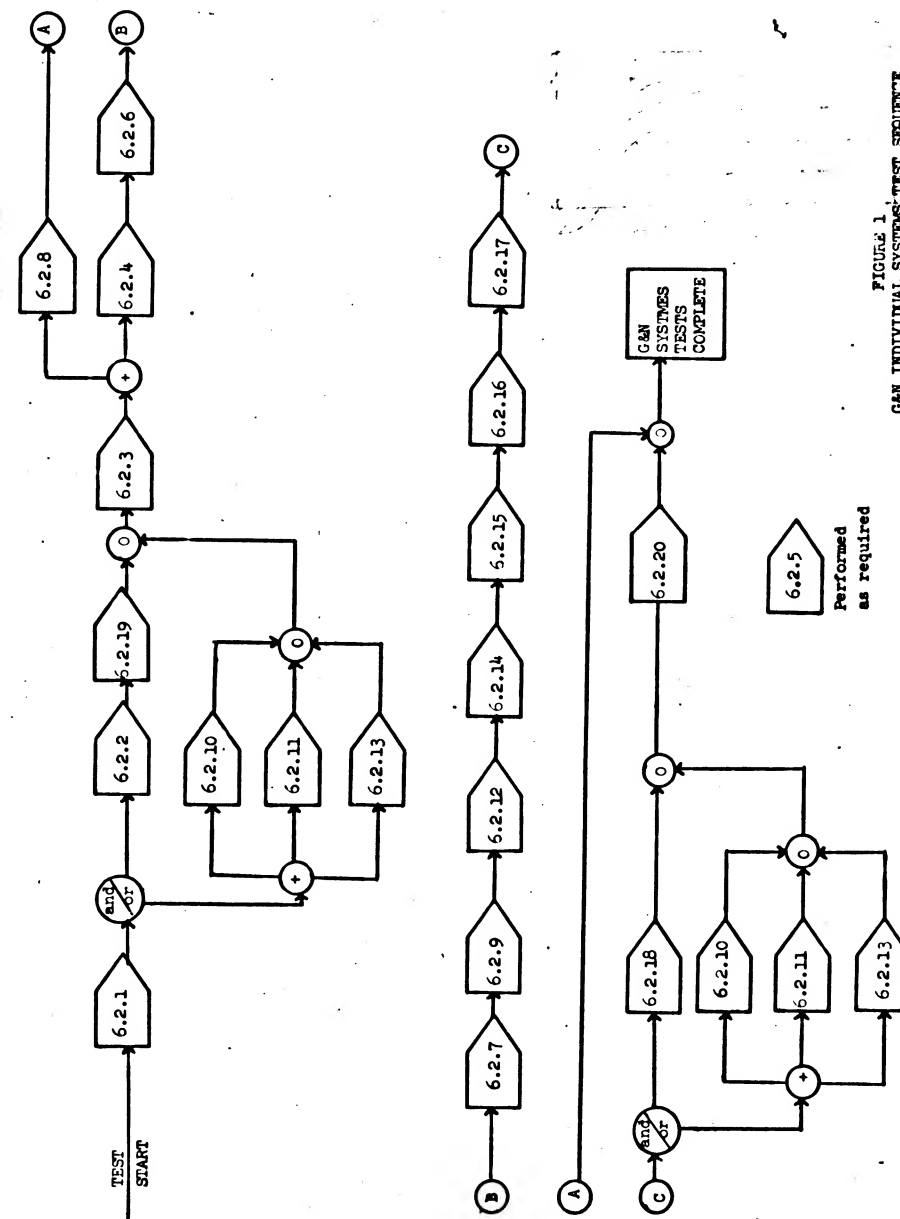
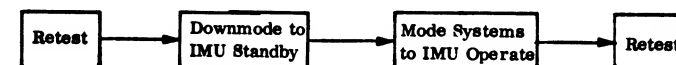


FIGURE 1
CAN INDIVIDUAL SYSTEMS TEST SEQUENCE

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| | | | | | | | |

5.4.2 Failure of the D criteria for IRIG and PIPA parameters.

5.4.2.1 If D_1 , D_2 , or D_3 exceeds its maximum value as specified in Table D, Paragraph 6.2.16.10.8 for any IRIG or PIPA, a retest sequence shall be initiated as indicated below:



RETEST SEQUENCE

The retest sequence shall be performed using the paragraphs indicated in Table I corresponding to the out-of-spec parameters. Table 2 indicates the test positions and other isolated parameters that must be recalculated and qualified.

If D_1 , D_2 , or D_3 exceeds its maximum value after the retest sequence is completed, the requirements of 5.4.2.2 (IRIG) or 5.4.2.3 (PIPA) shall apply. If D_1 , D_2 , and D_3 are within tolerances specified in Table D after the retest sequence is completed, the original out-of-tolerance D terms calculated in paragraph 6.2.16.10.8 shall be exonerated.

5.4.2.2 IRIG stability requirements.

5.4.2.2.1 Failure to be within the maximum values for D_1 or D_2 or D_3 after the retest sequence shall constitute failure of the unit.

5.4.2.3 PIPA stability requirements.

5.4.2.3.1 Failure to be within the maximum limits of D_1 or D_2 or D_3 after the retest sequence constitute failure of the unit.

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| O.C.E. PARAMETERS | | PARAMETER NUMBERS | | 6.2.16.7.1 where X is listed below | |
|-------------------|------------|-------------------|------------|------------------------------------|------------|
| 6.2.16.7.1 | 6.2.16.7.2 | 6.2.16.7.3 | 6.2.16.7.4 | 6.2.16.7.5 | 6.2.16.7.6 |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 |
| 37 | 38 | 39 | 40 | 41 | 42 |
| 43 | 44 | 45 | 46 | 47 | 48 |
| 49 | 50 | 51 | 52 | 53 | 54 |
| 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 |
| 67 | 68 | 69 | 70 | 71 | 72 |
| 73 | 74 | 75 | 76 | 77 | 78 |
| 79 | 80 | 81 | 82 | 83 | 84 |
| 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 |
| 97 | 98 | 99 | 100 | 101 | 102 |
| 103 | 104 | 105 | 106 | 107 | 108 |
| 109 | 110 | 111 | 112 | 113 | 114 |
| 115 | 116 | 117 | 118 | 119 | 120 |
| 121 | 122 | 123 | 124 | 125 | 126 |
| 127 | 128 | 129 | 130 | 131 | 132 |
| 133 | 134 | 135 | 136 | 137 | 138 |
| 139 | 140 | 141 | 142 | 143 | 144 |
| 145 | 146 | 147 | 148 | 149 | 150 |
| 151 | 152 | 153 | 154 | 155 | 156 |
| 157 | 158 | 159 | 160 | 161 | 162 |
| 163 | 164 | 165 | 166 | 167 | 168 |
| 169 | 170 | 171 | 172 | 173 | 174 |
| 175 | 176 | 177 | 178 | 179 | 180 |
| 181 | 182 | 183 | 184 | 185 | 186 |
| 187 | 188 | 189 | 190 | 191 | 192 |
| 193 | 194 | 195 | 196 | 197 | 198 |
| 199 | 200 | 201 | 202 | 203 | 204 |
| 205 | 206 | 207 | 208 | 209 | 210 |
| 211 | 212 | 213 | 214 | 215 | 216 |
| 217 | 218 | 219 | 220 | 221 | 222 |
| 223 | 224 | 225 | 226 | 227 | 228 |
| 229 | 230 | 231 | 232 | 233 | 234 |
| 235 | 236 | 237 | 238 | 239 | 240 |
| 241 | 242 | 243 | 244 | 245 | 246 |
| 247 | 248 | 249 | 250 | 251 | 252 |
| 253 | 254 | 255 | 256 | 257 | 258 |
| 259 | 260 | 261 | 262 | 263 | 264 |
| 265 | 266 | 267 | 268 | 269 | 270 |
| 271 | 272 | 273 | 274 | 275 | 276 |
| 277 | 278 | 279 | 280 | 281 | 282 |
| 283 | 284 | 285 | 286 | 287 | 288 |
| 289 | 290 | 291 | 292 | 293 | 294 |
| 295 | 296 | 297 | 298 | 299 | 300 |
| 301 | 302 | 303 | 304 | 305 | 306 |
| 307 | 308 | 309 | 310 | 311 | 312 |
| 313 | 314 | 315 | 316 | 317 | 318 |
| 319 | 320 | 321 | 322 | 323 | 324 |
| 325 | 326 | 327 | 328 | 329 | 330 |
| 331 | 332 | 333 | 334 | 335 | 336 |
| 337 | 338 | 339 | 340 | 341 | 342 |
| 343 | 344 | 345 | 346 | 347 | 348 |
| 349 | 350 | 351 | 352 | 353 | 354 |
| 355 | 356 | 357 | 358 | 359 | 360 |
| 361 | 362 | 363 | 364 | 365 | 366 |
| 367 | 368 | 369 | 370 | 371 | 372 |
| 373 | 374 | 375 | 376 | 377 | 378 |
| 379 | 380 | 381 | 382 | 383 | 384 |
| 385 | 386 | 387 | 388 | 389 | 390 |
| 391 | 392 | 393 | 394 | 395 | 396 |
| 397 | 398 | 399 | 400 | 401 | 402 |
| 403 | 404 | 405 | 406 | 407 | 408 |
| 409 | 410 | 411 | 412 | 413 | 414 |
| 415 | 416 | 417 | 418 | 419 | 420 |
| 421 | 422 | 423 | 424 | 425 | 426 |
| 427 | 428 | 429 | 430 | 431 | 432 |
| 433 | 434 | 435 | 436 | 437 | 438 |
| 439 | 440 | 441 | 442 | 443 | 444 |
| 445 | 446 | 447 | 448 | 449 | 450 |
| 451 | 452 | 453 | 454 | 455 | 456 |
| 457 | 458 | 459 | 460 | 461 | 462 |
| 463 | 464 | 465 | 466 | 467 | 468 |
| 469 | 470 | 471 | 472 | 473 | 474 |
| 475 | 476 | 477 | 478 | 479 | 480 |
| 481 | 482 | 483 | 484 | 485 | 486 |
| 487 | 488 | 489 | 490 | 491 | 492 |
| 493 | 494 | 495 | 496 | 497 | 498 |
| 499 | 500 | 501 | 502 | 503 | 504 |
| 505 | 506 | 507 | 508 | 509 | 510 |
| 511 | 512 | 513 | 514 | 515 | 516 |
| 517 | 518 | 519 | 520 | 521 | 522 |
| 523 | 524 | 525 | 526 | 527 | 528 |
| 529 | 530 | 531 | 532 | 533 | 534 |
| 535 | 536 | 537 | 538 | 539 | 540 |
| 541 | 542 | 543 | 544 | 545 | 546 |
| 547 | 548 | 549 | 550 | 551 | 552 |
| 553 | 554 | 555 | 556 | 557 | 558 |
| 559 | 560 | 561 | 562 | 563 | 564 |
| 565 | 566 | 567 | 568 | 569 | 570 |
| 571 | 572 | 573 | 574 | 575 | 576 |
| 577 | 578 | 579 | 580 | 581 | 582 |
| 583 | 584 | 585 | 586 | 587 | 588 |
| 589 | 590 | 591 | 592 | 593 | 594 |
| 595 | 596 | 597 | 598 | 599 | 600 |
| 601 | 602 | 603 | 604 | 605 | 606 |
| 607 | 608 | 609 | 610 | 611 | 612 |
| 613 | 614 | 615 | 616 | 617 | 618 |
| 619 | 620 | 621 | 622 | 623 | 624 |
| 625 | 626 | 627 | 628 | 629 | 630 |
| 631 | 632 | 633 | 634 | 635 | 636 |
| 637 | 638 | 639 | 640 | 641 | 642 |
| 643 | 644 | 645 | 646 | 647 | 648 |
| 649 | 650 | 651 | 652 | 653 | 654 |
| 655 | 656 | 657 | 658 | 659 | 660 |
| 661 | 662 | 663 | 664 | 665 | 666 |
| 667 | 668 | 669 | 670 | 671 | 672 |
| 673 | 674 | 675 | 676 | 677 | 678 |
| 679 | 680 | 681 | 682 | 683 | 684 |
| 685 | 686 | 687 | 688 | 689 | 690 |
| 691 | 692 | 693 | 694 | 695 | 696 |
| 697 | 698 | 699 | 700 | 701 | 702 |
| 703 | 704 | 705 | 706 | 707 | 708 |
| 709 | 710 | 711 | 712 | 713 | 714 |
| 715 | 716 | 717 | 718 | 719 | 720 |
| 721 | 722 | 723 | 724 | 725 | 726 |
| 727 | 728 | 729 | 730 | 731 | 732 |
| 733 | 734 | 735 | 736 | 737 | 738 |
| 739 | 740 | 741 | 742 | 743 | 744 |
| 745 | 746 | 747 | 748 | 749 | 750 |
| 751 | 752 | 753 | 754 | 755 | 756 |
| 757 | 758 | 759 | 760 | 761 | 762 |
| 763 | 764 | 765 | 766 | 767 | 768 |
| 769 | 770 | 771 | 772 | 773 | 774 |
| 775 | 776 | 777 | 778 | 779 | 780 |
| 781 | 782 | 783 | 784 | 785 | 786 |
| 787 | 788 | 789 | 790 | 791 | 792 |
| 793 | 794 | 795 | 796 | 797 | 798 |
| 799 | 800 | 801 | 802 | 803 | 804 |
| 805 | 806 | 807 | 808 | 809 | 810 |
| 811 | 812 | 813 | 814 | 815 | 816 |
| 817 | 818 | 819 | 820 | 821 | 822 |
| 823 | 824 | 825 | 826 | 827 | 828 |
| 829 | 830 | 831 | 832 | 833 | 834 |
| 835 | 836 | 837 | 838 | 839 | 840 |
| 841 | 842 | 843 | 844 | 845 | 846 |
| 847 | 848 | 849 | 850 | 851 | 852 |
| 853 | 854 | 855 | 856 | 857 | 858 |
| 859 | 860 | 861 | 862 | 863 | 864 |
| 865 | 866 | 867 | 868 | 869 | 870 |
| 871 | 872 | 873 | 874 | 875 | 876 |
| 877 | 878 | 879 | 880 | 881 | 882 |
| 883 | 884 | 885 | 886 | 887 | 888 |
| 889 | 890 | 891 | 892 | 893 | 894 |
| 895 | 896 | 897 | 898 | 899 | 900 |
| 901 | 902 | 903 | 904 | 905 | 906 |
| 907 | 908 | 909 | 910 | 911 | 912 |
| 913 | 914 | 915 | 916 | 917 | 918 |
| 919 | 920 | 921 | 922 | 923 | 924 |
| 925 | 926 | 927 | 928 | 929 | 930 |
| 931 | 932 | 933 | 934 | 935 | 936 |
| 937 | 938 | 939 | 940 | 941 | 942 |
| 943 | 944 | 945 | 946 | 947 | 948 |
| 949 | 950 | 951 | 952 | 953 | 954 |
| 955 | 956 | 957 | 958 | 959 | 960 |
| 961 | 962 | 963 | 964 | 965 | 966 |
| 967 | 968 | 969 | 970 | 971 | 972 |
| 973 | 974 | 975 | 976 | 977 | 978 |
| 979 | 980 | 981 | 982 | 983 | 984 |
| 985 | 986 | 987 | 988 | 989 | 990 |
| 991 | 992 | 993 | 994 | 995 | 996 |
| 997 | 998 | 999 | 1000 | 1001 | 1002 |
| 1003 | 1004 | 1005 | 1006 | 1007 | 1008 |
| 1009 | 1010 | 1011 | 1012 | 1013 | 1014 |
| 1015 | 1016 | 1017 | 1018 | 1019 | 1020 |
| 1021 | 1022 | 1023 | 1024 | 1025 | 1026 |
| 1027 | 1028 | 1029 | 1030 | 1031 | 1032 |
| 1033 | 1034 | 1035 | 1036 | 1037 | 1038 |
| 1039 | 1040 | 1041 | 1042 | 1043 | 1044 |
| 1045 | 1046 | 1047 | 1048 | 1049 | 1050 |
| 1051 | 1052 | 1053 | 1054 | 1055 | 1056 |
| 1057 | 1058 | 1059 | 1060 | 1061 | 1062 |
| 1063 | 1064 | 1065 | 1066 | 1067 | 1068 |
| 1069 | 1070 | 1071 | 1072 | 1073 | 1074 |
| 1075 | 1076 | 1077 | 1078 | 1079 | 1080 |
| 1081 | 1082 | 1083 | 1084 | 1085 | 1086 |
| 1087 | 1088 | 1089 | 1090 | 1091 | 1092 |
| 1093 | 1094 | 1095 | 1096 | 1097 | 1098 |
| 1099 | 1100 | 1101 | 1102 | 1103 | 1104 |
| 1105 | 1106 | 1107 | 1108 | 1109 | 1110 |
| 1111 | 1112 | 1113 | 1114 | 1115 | 1116 |
| 1117 | 1118 | 1119 | 1120 | 1121 | 1122 |
| 1123 | 1124 | 1125 | 1126 | 1127 | 1128 |
| 1129 | 1130 | 1131 | 1132 | 1133 | 1134 |
| 1135 | 1136 | 1137 | 1138 | 1139 | 1140 |
| 1141 | 1142 | 1143 | 1144 | 1145 | 1146 |
| 1147 | 1148 | 1149 | 1150 | 1151 | 1152 |
| 1153 | 1154 | 1155 | 1156 | 1157 | 1158 |
| 1159 | 1160 | 1161 | 1162 | 1163 | 1164 |
| 1165 | 1166 | 1167 | 1168 | 1169 | 1170 |
| 1171 | 1172 | 1173 | 1174 | 1175 | 1176 |
| 1177 | 1178 | 1179 | 1180 | 1181 | 1182 |
| 1183 | 1184 | 1185 | 1186 | 1187 | 1188 |
| 1189 | 1190 | 1191 | 1192 | 1193 | 1194 |
| 1195 | 1196 | 1197 | 1198 | 1199 | 1200 |
| 1201 | 1202 | 1203 | 1204 | 1205 | 1206 |
| 1207 | 1208 | 1209 | 1210 | 1211 | 1212 |
| 1213 | 1214 | 1215 | 1216 | 1217 | 1218 |
| 1219 | 1220 | 1221 | 1222 | 1223 | 1224 |
| 1225 | 1226 | 1227 | 1228 | 1229 | 1230 |
| 1231 | 1232 | 1233 | 1234 | 1235 | 1236 |
| 1237 | 1238 | 1239 | 1240 | 1241 | 1242 |
| 1243 | 1244 | 1245 | 1246 | 1247 | 1248 |
| 1249 | 1250 | 1251 | 1252 | 1253 | 1254 |
| 1255 | 1256 | 1257 | 1258 | 1259 | 1260 |
| 1261 | 1262 | 1263 | 1264 | 1265 | 1266 |
| 1267 | 1268 | 1269 | 1270 | 1271 | 1272 |
| 1273 | 1274 | 1275 | 1276 | 1277 | 1278 |
| 1279 | 1280 | 1281 | 1282 | 1283 | 1284 |
| 1285 | 1286 | 1287 | 1288 | 1289 | 1290 |
| 1291 | 1292 | 1293 | 1294 | 1295 | 1296 |
| 1297 | 1298 | 1299 | 1300 | 1301 | 1302 |
| 1303 | 1304 | 1305 | 1306 | 1307 | 1308 |
| 1309 | 1310 | 1311 | 1312 | 1313 | 1314 |
| 1315 | 1316 | 1317 | 1318 | 1319 | 1320 |
| 1321 | 1322 | | | | |

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TABLE 2

| O.O.S. PARAMETER | PERFORM POSITIONS | PARAMETERS TO BE REQUALIFIED |
|----------------------|-----------------------|----------------------------------|
| NBDY | 1 | NBDY |
| NBDZ | 2 | NBDZ |
| NBDX | 3 | NBDX |
| ADSRAY | 1 and 4 | ADSRAY, NBDY |
| ADSRAX | 2 and 9 | ADSRAX, NBDZ |
| ADSRAX | 3 and 7 | ADSRAX, NBDX |
| ADLAY | 1 thru 3, 7 and 10 | NBDY, NBDX, ADLAX, ADSRAX, ADLAY |
| ADLAZ | 2 thru 4 | NBDZ, NBDX, ADLAZ |
| ADLAX | 1 thru 3 | NBDX, ADLAX, NBDY |
| X PIPA Bias or S. F. | 1 thru 2 | X PIPA BIAS, X PIPA S. F. |
| Y PIPA Bias or S. F. | 5 and 6 | Y PIPA BIAS Y PIPA S. F. |
| Z PIPA Bias or S. F. | 3 and 4 | Z PIPA Bias, Z PIPA S. F. |

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| | | | | | | | | | | | |
| 5.5 | Retest subsequent to replacement of a malfunctioned assembly with that of a flight certified assembly shall be at the discretion of NASA Engineering. Table II can be used as a guide to determine general retest requirements. In all retest procedures, the test sequence of Figure 1 shall be adhered to. | | | | | | | | | | |
| 5.5.1 | The resistance between the CMC case and structural ground shall be less than .05 ohms. | | | | | | | | | | |
| 5.6 | It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps related directly to the G&N System components. If any questions arise concerning the test equipment, the Test Conductor should refer to the pertinent operational manuals. | | | | | | | | | | |
| 5.7 | The following requirements shall be completed before any of the tests in this specification are attempted. | | | | | | | | | | |
| 5.7.1 | The G&N System shall be Government Furnished Property. | | | | | | | | | | |
| 5.7.2 | The installation of the G&N System into the spacecraft shall have been completed as specified in Mechanical Installation Specification for Apollo Guidance Equipment Block II MA0308-0107. | | | | | | | | | | |
| 5.7.2.1 | Interfacing systems (SCS, C & IS, EPS, ECS) shall have been verified to conform to loading and operational requirements as specified by the appropriate ICD. | | | | | | | | | | |
| 5.7.3 | All ACE equipment shall have been qualified in accordance with the respective quality assurance specifications prior to use with the G&N System. | | | | | | | | | | |

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TABLE II. RETEST MATRIX

| Paragraph Number | Test Title | IMU | NAV BASE | OPTICS | CMC | PSA | LEB DSKY | MDC DSKY | SIG. COND. | CDU | G&N HARNESS | PIPA ELECT. | INDICATOR CONTROL PANEL |
|------------------|--|-----|----------|--------|-----|-----|----------|----------|------------|-----|-------------|-------------|-------------------------|
| 5.5.1 | AGC Ground Check | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.1 | Application of Standby Power to G&N System | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.5 | General Turn Off and Turn On Procedure | X | X | * | X | X | X | X | X | X | X | X | X |
| 6.2.3 | Operate Power On Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.2 | CMC Operational Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.8 | G&N Panel Brightness and Lamp Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.6 | G&N Operational Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.10 | Zero Optics Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.13 | Optics Slew Rate Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.11 | Optics Coordinate Transformation Control | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.12 | Optics Function Test - VAB and PAD | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.9 | Semi-Automatic Mode Control Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.14 | Stab Loop Step Response Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.15 | IRIG Scale Factor Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.16 | IMU Performance Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.17 | Fine Alignment Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.19 | Voltage Margin Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.17 | Gimbal Friction Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.18 | Gyrocompassing Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.4 | G&N Power Supplies Test | X | X | | X | X | X | X | X | X | X | X | X |
| 6.2.10 | S/G Control & Display Test | X | X | | X | X | X | X | X | X | X | X | X |

* To be used as necessary to turn system on and off.

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- 5.8 The following conditions are required for testing the G&N System.
- 5.8.1 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N System is being conducted.
- 5.8.2 The G&N System shall be supported by the Electrical Power System and Environmental Control System during operation in the Command Module. The Stabilization and Control System shall be connected to the G&N System during G&N operation in the Command Module for passive loading purposes if available.
- 5.8.3 During tests which interface with the Stabilization and Control System and the Central Timing System, operation of these systems shall be required.
- 5.9 The G&N System shall be tested per this specification after it is installed in the spacecraft. In the event that the installed system, or any assembly thereof, is removed from the spacecraft for modification, recycle, or any other reason, this process specification or pertinent portions of it shall be performed after the G&N System or assembly thereof, is reinstalled. Testing shall be limited to G&N System operation while actively connected to qualified spacecraft threshold systems, namely, the Electrical Power System (EPS), Environmental Control System (ECS), and Communication and Instrumentation System (C&IS) as much as possible. However, a minimum of combined and integrated system testing with the Stabilization and Control System (SCS). However, a minimum of combined and integrated system testing with the Stabilization and Control System (SCS), Central Timing System (CTS) and Caution and Warning System is required for complete G&N System Verification.

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- 5.10 The test equipment listed in paragraph 4.1 shall be connected and ready for operation before the tests of this specification are initiated.
- 5.11 Data Records
- 5.11.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance readings shall be recorded and flagged by appropriate symbols.
- 5.11.1.1 All test data obtained while demonstrating the requirements of this document shall be permanently recorded and forwarded to the next receiving agency.
- 5.11.1.2 A record of the amount of time each of the four prime power busses are on shall be kept and forwarded to the next receiving agency.
- 5.12 Interface
- 5.12.1 The APOLLO G&N System shall interface with accepted ECS and EPS distribution systems for power and environment control purposes and with the SCS or SCS substitute system for signal interface in accordance with the applicable ICD's.
- 5.13 General System Operating characteristics.
- 5.13.1 The program does not automatically display computer error codes when a PROG alarm occurs. If error code is desired enter the following on K-148 and then observe the DSKY display.
- VERB 05 NOUN 09 ENTR
- R1 = FAILREG
R2 = FAILREG +1
R3 = FAILREG+2
- 5.13.2 The DSKY "NO ATT" lamp illuminates any time the system is in the Coarse Align Mode.

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6.0 DETAIL REQUIREMENTS

6.1 Initial Test Conditions

6.1.1 The following precautions shall be observed to preclude loss of continuity in inertial component performance history of the IMU. Deviation may necessitate recalibration of the inertial components.

6.1.1.1 The IMU shall be supplied with heater power on a continuous basis. When S/C Ground Power Supply, Model No. C14-418 is not providing heater power, then the heater power shall be supplied through the Portable Temperature Controller (PTC) Model No. 823-011. The temperature of the IRIG's shall be maintained between 120° and 150°F. The temperature of the PIPA's shall be maintained between 115° and 145°F.

6.1.1.2 The Standby Mode is identified by the circuit breakers IMU HTR MN A, IMU HTR MN B, COMPUTER MN A and MN B in the ON position and the G&N Power-IMU switch on LEB Lighting Control Panel in the OFF position. The Operate Mode is identified by the circuit breaker IMU HTR MN A, MN B, COMPUTER MN A and MN B in the ON position and the G&N Power-IMU switch on the LEB Lighting Control Panel in the ON position. The G&N System shall be operating in the Standby Mode with CMC power ON for a minimum of two hours prior to advancing to the IMU Operate Mode. In the event Standby or CMC power is interrupted, an equivalent time period, but not less than 15 minutes, shall be allowed when power is restored before advancing to the Operate Mode, except that when the interval of interruption exceeds two hours, a two-hour warmup period shall be mandatory (exceptions to the 2-hour warmup are noted in 6.2.5.2).

6.1.1.3 The Inertial Measurement Unit shall not be without heater power for more than 15 minutes.

6.1.1.4 During the turn on of the G&N power, COMPUTER MN A and MN B and IMU HTR MN A and IMU HTR MN B circuit breakers must be turned on before the IMU MN A and IMU MN B circuit breakers on the Right Hand Circuit Breaker Panel of the CM. During the turn off of the G&N power the IMU MN A and IMU MN B circuit breakers must be turned off before the IMU HTR MN A and IMU HTR MN B circuit breakers on the Right Hand Circuit Breaker Panel of the CM. In no case shall COMPUTER MN A and MN B circuit breaker be turned off before IMU MN A and MN B circuit breakers.

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- 6.1.1.5 A warmup period of 1 hour with OPERATE power applied shall be required prior to performing any test in which gyro and accelerometer parameters are measured, and 15 minutes warmup prior to any test in which precision amplitude and frequency power supply checks are made.
- 6.1.1.6 The following Command Module switches shall be in the position shown unless specifically directed otherwise in a procedural function.
- a. UP TLM switches on the LEB G&N Control Panel and MDC Panel 2 shall be set to ACCEPT.
 - b. LAUNCH VEHICLE - GUIDANCE switch on MDC Panel 2 shall be set to IU.
 - c. The SC CONT switch on MDC Panel 1 shall be set to CMC.
 - d. The CMC MODE switch on MDC Panel 1 shall be set to AUTO.
 - e. The V CG switch on MDC Panel 1 shall be set to CSM.
 - f. The LIGHTS-INTEGRAL control on the LEB Lighting Control Panel and the Left Hand Circuit Breaker panel shall be set to the minimum brightness - OFF position.
- 6.1.2 The following optical reference alignment requirements shall be demonstrated - MSO only.
- 6.1.2.1 G&N Installation Qualification Fixture.
- 6.1.2.1.1 The SXT Optical Reference No. 1 (Azimuth Autoset) LOS shall be located approximately 40 degrees (CW when viewed from above) from the SCZ axis measured in a horizontal plane. At this position, the Optical Reference shall be capable of being viewed through the SXT ST LOS.
- 6.1.2.1.2 The SXT Optical Reference LOS position with respect to the horizontal plane shall be known to within 5 arc-seconds. The azimuth bearing of the Optical Reference LOS shall be known to within ± 30 minutes of arc.
- 6.1.2.1.3 The SXT Optical Reference No. 2 LOS shall be located approximately 80 degrees from the SXT Optical Reference No. 1 (40 degrees from S/C Z axis) measured in a horizontal plane. At this position, the Optical Reference shall be capable of being viewed through the SXT STAR LOS.
- 6.1.2.1.3.1 The SXT optical reference LOS position with respect to the horizontal plane shall be known to within 5 arc-seconds. The azimuth bearing of the Optical Reference LOS shall be known to within ± 30 minutes of arc.
- 6.1.2.1.4 SXT Optical Reference No. 3 shall be capable of being viewed through the SXT LLOS and the STAR LOS simultaneously at the Zero Optics position.

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- 6.1.2.1.4.1 SXT Optical Reference No. 3 shall have the capability to measure the non-parallelism of the LLOS and STAR LOS to a resolution of 2 arc-seconds.
- 6.1.3 Deleted.
- 6.1.4 Emergency Shutdown Procedure
- CAUTION: In the event of a malfunction occurrence which could damage the G&N System before the normal shutdown procedure 6.2.5 could be performed, the following sequence should be utilized in the spacecraft.
- 6.1.4.1 On the LEB Lighting Control Panel set the G/N POWER-IMU and G/N POWER - OPTICS switches to OFF.
- 6.1.4.2 On the Right Hand Circuit Breaker Panel set the following switches and circuit breakers to OFF (breakers pulled out).
- GUIDANCE/NAVIGATION COMPUTER MN A and MN B
 - GUIDANCE/NAVIGATION IMU HTR MN A and MN B
 - G/N POWER switch to OFF
 - GUIDANCE/NAVIGATION IMU MN A and MN B
 - GUIDANCE/NAVIGATION OPTICS MN A and MN B
 - GUIDANCE/NAVIGATION POWER AC 1 and AC 2
- 6.1.4.3 Verify that the PTC is providing heater power to the G&N System.

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- 6.2 Test Procedures
- 6.2.1 Application of Standby Power to G&N System
- 6.2.1.1 All power and control switches on the G&N Indicator Control Panel shall be placed in the OFF or neutral position.
- 6.2.1.2 The Portable Temperature Controller (PTC), shall be supplying inertial component heater power to the G&N System through the PSA, Connector No. 45J2.
- 6.2.1.3 Computer Power On
- 6.2.1.3.1 Set the POWER-AC1 and AC2 breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in), and position G/N POWER switch to AC1.
- 6.2.1.3.2 Set the G&N COMPUTER MN A and MN B Breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in).
- 6.2.1.3.3 Set the computer numerical display lights to the minimum acceptable brightness by rotating the Brightness Controls on the MDC and LEB Lighting Control Panels.
- 6.2.1.3.4 The +28 VDC CMC OPERATE voltage (CG 1520) shall be $+28.8 \pm 3$ VDC. Verify CRT indication. On DSKY verify TEMP light is ON. On the G&N Indicator Control Panel verify PGNS light is ON.
- 6.2.1.3.5 The voltage output of the +4 VDC CMC supply shall be $+4.00 \pm 0.20$ VDC, (CG1030). The value on the CRT shall be recorded.
- 6.2.1.3.6 The voltage output of the +14 VDC CMC supply shall be $+14.0 \pm 0.4$ VDC, (CG1020). The value on the CRT shall be recorded.
- 6.2.1.3.7 Using DSKY, enter VERB 36, ENTR, then press RESET. Verify that R1, R2 and R3 are blank and PROG = 00.
- 6.2.1.3.8 IMU HTR Heater Power On
- 6.2.1.3.8.1 Enter the IMU Standby Mode of operation by engaging the IMU HTR MN A and MN B breakers on the Right Hand Circuit Breaker Panel (breakers pushed in).
NOTE: Restart Lamp may illuminate, if it does, disregard and press RSET on the DSKY.
- 6.2.1.3.8.2 Verify that the IMU +28 VDC STANDBY discrete lamp on Event Module is illuminated (CG 1513). On DSKY verify TEMP light is extinguished. On the G&N Indicator Control Panel verify PGNS light is extinguished.

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6.2.1.3.8.3 Record the value of the following signals displayed on the CRT.

| Signal | Requirement |
|--|---------------|
| a. CG 1331 28V 3200 CPS POWER SUPPLY FEEDBACK | 28.6±0.6 VRMS |
| b. CG 1510 + 28 VDC STANDBY POWER | 28.8±3 VDC |

6.2.1.3.8.4 The PIPA TEMP on the CRT shall be monitored at 15 min., 1 hr. and 2 hrs. from execution of 6.2.1.4.1 to insure that the PIPA Temperature Control Loop circuitry is operating to maintain a temperature of 130.5±1.5°F (CG2300).

6.2.1.3.8.5 At the termination of the 2-hour period, record the PIPA temperature (CG2300) on the CRT. On the event recorder verify that the IMU HEATER current discrete (CG2302) is ON and that the IMU BLOWER current discrete (CG2303) is OFF over the last two hour period (occasionally discretes may cycle).

6.2.1.3.8.6 With the eyepiece in the Eyepiece Storage Unit, check the eyepiece surface temperature at the quick disconnect flange using an L&N #8693 Temperature Potentiometer, or a similar type thermocouple probe meter. Record both the ambient and eyepiece surface temperatures and verify that the eyepiece surface temperature is at least 10°F above the ambient temperature.

6.2.1.3.9 Zero the CMC erasable memory by entering the following sequence into the K-start:

- a. VERB 92, ENTER
- b. 00015, ENTER

6.2.1.3.10 Initiate CMC self-check by entering the following sequence into the K-start:

- a. VERB 21 NOUN 27, ENTER
- b. 77777, ENTER
- c. VERB 15 NOUN 01, ENTER
- d. 1366, ENTER

6.2.1.3.10.1 Monitor until R2 (SCOUNT +1) increments twice. If an error is detected, the PROGRAM ALARM lamp on the DSKY's shall light.

6.2.1.3.10.2 Terminate the monitor routine by entering the following into the DSKY.
VERB 34, ENTER

6.2.1.3.10.3 Enter the following into the K-start:

- a. VERB 21
- b. NOUN 27, press ENTER pushbutton
- c. 00000, press ENTER pushbutton

6.2.2 CMC Operational Test

NOTE: Verify that IMU STANDBY power (including CMC operate power) is applied, IMU OPERATE Power is not applied. (G&N IMU HTR MN A and MN B breakers engaged, Computer MN A and MN B breakers engaged, IMU MN A and MN B breakers disengaged, G/N Power-IMU switch on LEB Lighting Control Panel in OFF Position).

6.2.2.1 Using the LEB CMC DSKY, enter the following sequence of data into the CMC to initiate the DSKY check. Press the ENTER pushbutton after each entry (denoted by E).

VERB 36, E Press RESET

VERB 21 NOUN 27, E

TTTT66, E

6.2.2.2 DSKY check shall check all the electroluminescent elements by displaying the decimal numbers from nine through zero in succession, each set of numbers shall be displayed for approximately 5 seconds. Verify all elements operable on MDC and LEB CMC DSKY's. VERB-NOUN display shall flash.

6.2.2.2.1 Minus and plus signs shall be displayed. Verify operation on MDC and LEB DSKY's.

6.2.2.2.2 COMP ACTY lamp shall be illuminated for approximately 5 seconds, then DSKY shall blank.

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- 6.2.2.3 CAUTION and STATUS Displays
- 6.2.2.3.1 Enter VERB 35, ENTR, into LEB CMC DSKY.
- 6.2.2.3.2 The following MDC and LEB CMC DSKY displays shall illuminate for approximately 5 seconds.
- a. UPLINK ACTY
 - b. NO ATT
 - c. STBY
 - d. KEY REL Flashing
 - e. TEMP
 - f. GIMBAL LOCK
 - g. PROG
 - h. RESTART
 - i. TRACKER
 - j. OPR ERROR Flashing
 - k. COMP ACTY
 - l. VERB-NOUN Flashing
 - m. Plus 88888 in R1, R2, and R3
 - n. PGWCS. CMC. IS3 Warning lights (CMC shall remain illuminated for 15±5 seconds.
- After indications a through l go out +88888 shall remain in R1, R2, R3.

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- 6.2.2.4 DSKY Pushbutton Check
- 6.2.2.4.1 Enter the following sequence into the LEB CMC DSKY. Press the ENTER pushbutton after each entry (denoted by E).
- a. VERB 25 NOUN 01, E
 - b. 02100, E
 - c. +00123, E
 - d. -00456, E
 - e. -00789, E
- 6.2.2.4.2 The LEB CMC DSKY shall indicate +00123 in R1, -00456 in R2, and -00789 in R3.
- 6.2.2.4.3 Enter VERB 05, NOUN 01 into the LEB CMC DSKY. Press the ENTER pushbutton.
- 6.2.2.4.4 Enter 02100 into LEB CMC DSKY. Press the ENTER pushbutton. The LEB CMC DSKY shall indicate 00024 in R1, 77664 in R2, and 77576 in R3. Verify.
- 6.2.2.4.5 Enter the following sequence into the LEB CMC DSKY.
- a. VERB 21 NOUN 01, ENTER
 - b. 02100, ENTER
 - c. +00123, DO NOT press ENTER
- 6.2.2.4.5.1 Press the CLEAR pushbutton. R1 shall clear.
- 6.2.2.4.6 Enter VERB 16 NOUN 70 into the LEB CMC DSKY. Press the ENTER pushbutton. The operator Error Light shall light.
- 6.2.2.4.6.1 Press the RESET pushbutton. The Operator Error light shall extinguish.
- 6.2.2.4.7 Enter the following sequence into the LEB CMC DSKY. Press the ENTER pushbutton as indicated. The Key Release Light shall light.
- a. VERB 16, NOUN 20, ENTER
 - b. VERB
- 6.2.2.4.7.1 Press the KEY RELEASE pushbutton. The Key Release light shall extinguish.
- 6.2.2.4.7.2 Enter VERB 36, into the LEB CMC DSKY. Press the ENTER pushbutton.
- NOTE: 6.2.2.4.8 does not apply to 2TV-1.
- 6.2.2.4.8 Enter the following sequence into the LEB CMC DSKY.
- a. VERB 11 NOUN 10, ENTER
 - b. 00032, ENTER

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Press the STANDBY proceed pushbutton once and verify that "5XXXX" is displayed in R1. Press the STANDBY pushbutton again and verify that "7XXXX" is displayed in R1. Enter VERB 34 and press the ENTER pushbutton.

- 6.2.2.4.9 Repeat 6.2.2.4.1 through 6.2.2.4.8 using the MDC CMC DSKY.
- 6.2.2.5 Uplink and Downlink Checks.
- 6.2.2.5.1 Enter VERB 36 into K148. Press the ENTER pushbutton, then press ERROR RESET pushbutton.
- 6.2.2.5.2 Enter the following sequence into K148. Press the ENTER pushbutton after each entry.
- a. VERB 25 NOUN 01 ENTER
 - b. 02100, ENTER
 - c. 00000, ENTER
 - d. 77777, ENTER
 - e. 07254, ENTER
 - f. VERB 05 NOUN 01, ENTER
 - g. 02100, ENTER
- 6.2.2.5.3 CMC Registers R1, R2, and R3 display on the CRT shall indicate 00000, 77777, and 07254, respectively.
- 6.2.2.5.4 Set/Verify that the UP TLM switch on the Main Display Panel is set to ACCEPT and that the UP TLM switch on the G&N Indicator Control Panel is set to BLOCK.
- 6.2.2.5.5 Execute the Block Uplink Override R-START to enable data to be sent via K-START. On K-148 insert VERB. Verify that the VERB indications on the DSKY and CRT does not change.
- 6.2.2.5.6 Set the UP TLM switch on the G&N Indicator Control Panel to ACCEPT. Verify that the BLOCK UPLINK discrete is OFF.
- 6.2.2.5.7 On K-148 insert VERB 01. Verify that the VERB indication on the DSKY and CRT is 01.
- 6.2.2.5.8 Set the UP TLM switch on the MAIN DISPLAY Panel to BLOCK. Verify that the BLOCK UPLINK discrete is ON.
- 6.2.2.5.9 On K-148 insert VERB. Verify VERB indication on the DSKY and CRT does not change.
- 6.2.2.5.10 Set the UP TLM switch on the MAIN DISPLAY Panel to ACCEPT. Verify that the BLOCK UPLINK discrete is OFF. Remove the Block Uplink Override R-START.
- 6.2.2.5.11 On K-148 insert VERB 36. Press the ENTER pushbutton.

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- 6.2.2.6 Deleted
- 6.2.2.7 Parity Fail Test
- 6.2.2.7.1 Enter the following into the K-Start. Press the ENTER pushbutton after each entry.
- a. VERB 92, ENTER
 - b. 00015, ENTER
 - c. VERB 22 NOUN 02, ENTER
 - d. 02100 ENTER
 - e. 33777, ENTER
 - f. 04353, ENTER
 - g. VERB 25 NOUN 26, ENTER
 - h. 04000, ENTER
 - j. 01500 ENTER
 - k. 00004 ENTER
 - m. VERB 30, ENTER
- The RESTART lamps on the MDC & LEB DESKY's shall illuminate. The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.
- 6.2.2.7.2 Press the ERROR RESET pushbutton on the K-Start. The RESTART & PGNS caution lamps shall extinguish.
- 6.2.2.7.3 Enter VERB 36, into the K-START. Press the ENTER pushbutton.

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6.2.2.8 Rupt Lock Test

6.2.2.8.1 Enter the following sequence into the K-Start. Press the ENTER pushbutton after each entry.

- a. VERB 24 NOUN 01, ENTER
- b. 02100, ENTER
- c. 30001, ENTER
- d. 01600, ENTER
- e. VERB 25 NOUN 26, ENTER
- f. 00001, ENTER
- g. 01500, ENTER
- h. 00004, ENTER
- i. VERB 31, ENTER

The RESTART lamps on the MDC and LEB DSKY's shall illuminate. The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.

6.2.2.8.2 Press the ERROR RESET pushbutton on the K-START. The RESTART & PGNS caution lamps shall extinguish.

6.2.2.8.3 Enter VERB 36 into the K-Start. Press the ENTER pushbutton.

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6.2.2.9 TC Trap Test

6.2.2.9.1 Enter the following sequence into the K-Start. Press the ENTER pushbutton after each entry.

- a. VERB 21 NOUN 02, ENTER
- b. 02100, ENTER
- c. 01500, ENTER
- d. VERB 25 NOUN 26, ENTER
- e. 04000, ENTER
- f. 01500, ENTER
- g. 00004, ENTER
- h. VERB 30, ENTER

The RESTART lamps on the MDC & LEB DSKY's shall illuminate. The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.

6.2.2.9.2 Press the ERROR RESET pushbutton on the K-Start. The RESTART & PGNS caution lamps shall extinguish.

6.2.2.9.3 Enter VPPB 36 into the K-Start. Press the ENTER pushbutton.

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6.2.2.10 Nightwatchman Test

6.2.2.10.1 Enter the following sequence into the K-Start. Press ENTER pushbutton after each entry.

- a. VERB 24 NOUN 01, ENTER
- b. 02100, ENTER
- c. 30001, ENTER
- d. 01500, ENTER
- e. VERB 25 NOUN 26, ENTER
- f. 04000, ENTER
- g. 01500, ENTER
- h. 00004, ENTER
- i. VERB 30, ENTER

The RESTART lamps on the MDC & LEB DSKY's shall illuminate. The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.

6.2.2.10.2 Press the ERROR RESET pushbutton on the K-Start. The RESTART & PGNS caution lamps shall extinguish.

6.2.2.10.3 Enter VERB 36 into the K-Start. Press the ENTER pushbutton.

6.2.2.11 Bank Sum Check

6.2.2.11.1 From a program listing for the installed CMC ropes, obtain a list of bank CKSM bugger words.

6.2.2.11.2 Enter VERB 31, ENTER into K148.

6.2.2.11.3 Record the following:

- R1 = Bank Sum
- R2 = Bank Number
- R3 = Bank CKSM bugger word

R1 shall be the same or the complement of R2.
R3 shall equal the CKSM bugger word for the indicated bank.
Enter VERB 33, ENTER

6.2.2.11.4 Repeat 6.2.2.11.3 until all banks have been checked. Terminate the Bank Sum Test by entering VERB 34, ENTER into K148.

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- 6.2.2.12 CMC Clock Frequency Test.
- 6.2.2.12.1 Insure that CMC operate power has been applied for a minimum of 10 minutes before performing this test.
- 6.2.2.12.2 Verify that the counter is connected to the 3.2 kc signal on the hardline.
- 6.2.2.12.3 Insure that the counter has been warming up for a minimum of 30 minutes.
- 6.2.2.12.4 Cal the counter,
- Set the FUNCTION switch to: MAN START
Set the TIME BASE switch to: 1 usec TIME UNIT/COUNT
Set the SENSITIVITY control to: CHECK
- 6.2.2.12.5 Verify proper counter operation.
- 6.2.2.12.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.
- 6.2.2.12.7 Plug in the Preset unit and set:
- MODE switch to PRESET
N switches to 96000.
- 6.2.2.12.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.
- 6.2.2.12.9 Start counting by depressing RESET switch on counter.
- 6.2.2.12.10 After approximately 30 seconds, read and record counter display.
- 6.2.2.12.11 Repeat steps 6.2.2.12.9 and 6.2.2.12.10 nine times.
- 6.2.2.12.12 The average of the 10 previous readings shall be 30.000000±0.000060 seconds.
- 6.2.2.12.13 Insure that the system is not in IMU Operate.
- 6.2.2.12.14 Perform the following DSKY operations:
- | | | |
|---------|------|------|
| VERB 37 | ENTR | ENTR |
| 00006 | ENTR | ENTR |
| PROG | | ENTR |
- Press and hold the PRO pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is lighted.
- 6.2.2.12.15 Repeat steps 6.2.2.12.9 through 6.2.2.12.12.
- 6.2.2.12.16 Press and hold the PRO pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is not lighted.

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- 6.2.2.12.17 Perform the following DSKY operations:
VERB 37 ENTR
00005 ENTR
- 6.2.2.13 Minimum Impulse Controller Input Test.
- 6.2.2.13.1 Enter the following into the DSKY.
a. VERB 11 NOUN 10, ENTER
b. 00032 ENTER
- 6.2.2.13.2 Set the Minimum Impulse Controller on the Indicator Control Panel to the following position and observe R1 of the DSKY for the proper indications.
- | MIC Position | R1 DSKY Indication |
|---------------------|--------------------|
| a. Up | 77775 |
| b. Down | 77776 |
| c. Left | 77737 |
| d. Right | 77757 |
| e. Clockwise | 77773 |
| f. Counterclockwise | 77767 |
| g. Neutral | 77777 |
- 6.2.2.13.3 Enter VERB 34, ENTER into the DSKY.
- 6.2.2.14 Mark and Mark Reject pushbutton test.
- 6.2.2.14.1 On the G&N Indicator Control Panel press and hold MARK pushbutton.
- 6.2.2.14.2 Observe PROG alarm lamp is lighted.
- 6.2.2.14.3 Enter the following in K-148:
VERB 11 NOUN 10 ENTR
00016 ENTR
- 6.2.2.14.4 Observe that DSKY row 1 displays 00040.
- 6.2.2.14.5 Release MARK pushbutton.
- 6.2.2.14.6 Observe that DSKY Row 1 displays 00000. Press ERR RSET pushbutton.
- 6.2.2.14.7 Press and hold the REJECT pushbutton on the G&N Indicator Control Panel.

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6.2.2.14.8 Observe PROG alarm lamp is lighted.

6.2.2.14.9 Observe that DSKY Row 1 displays 00100.

6.2.2.14.10 Release the REJECT pushbutton.

6.2.2.14.11 Observe that DSKY Row 1 displays 00000. Press ERR RSET pushbutton.

6.2.2.14.12 On the DSKY perform the following operation:

VERB 36 ENTR

6.2.3 Operate Power On Test

6.2.3.1 IMU Operate Power ON

CAUTION: The sequences specified in this test must be adhered to. Deviations may necessitate recalibration of the inertial components.

NOTE: Disregard the GIMBAL LOCK indicator until the completion of Step 6.2.3.1.6.

6.2.3.1.1 The following Command Module switches and circuit breakers shall be in the following state:

Right Hand Circuit Breaker Panel

a. GUIDANCE/NAVIGATION COMPUTER MN A and MN B breakers on (pushed in)

b. GUIDANCE/NAVIGATION IMU HTR MN A and MN B breakers on (pushed in)

c. GUIDANCE/NAVIGATION IMU MN A and MN B breakers off (pulled out)

d. GUIDANCE/NAVIGATION OPTICS MN A and MN B breakers off (pulled out)

LEB Lighting Control Panel

e. G/N Power - IMU set to OFF

f. G/N Power - Optics set to OFF

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6.2.3.1.2 Switches and selectors on the G&N Indicator control panel shall be set as follows:

- a. OPTICS ZERO to ZERO
- b. OPTICS MODE to MANUAL
- c. OPTICS COUPLING to DIRECT
- d. OPTICS SPEED to MED
- e. OPTICS TEL TRUN to SLAVE to SXT
- f. RETICLE BRIGHTNESS to minimum brightness position

6.2.3.1.3 Adjust the Command Module MDC and LEB Lighting Controls to minimum intensity for proper readout of G&N Displays.

6.2.3.1.4 Set up the ACE analog recorders to monitor the following measurements (set chart speed to 5 mm/sec):

- a. CG 2117 IGA Servo Error In Phase
- b. CG 2177 OGA Servo Error In Phase
- c. CG 2147 MGA Servo Error In Phase
- d. CG 2112 IG IX Resolver Output Sin
- e. CG 2172 OG IX Resolver Output Sin
- f. CG 2142 MG IX Resolver Output Sin
- g. CG 1040 +120 VDC PIPA Supply DC Level

CAUTION: Before proceeding, insure that the G&N System has been operating in the STANDBY MODE (power configuration as defined in 6.2.3.1) for a minimum period of 2 hours. Exceptions to this requirement are noted in 6.2.5.2.9.

CAUTION NOTE: If the requirements of 6.2.3.1.6 are not met, remove IMU operate power immediately by placing the G/N POWER-IMU switch on the LEB Lighting Control Panel to OFF.

6.2.3.1.5 Perform the following sequence:

- a. Turn on the IMU MNA and MN B circuit breakers on the Right Hand Circuit Breaker Panel (breakers pushed in).
- b. Start Analog Recorders.
- c. Place G/N Power - IMU switch on the LEB Lighting Control Panel to IMU (switch toggle up).

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- 6.2.3.1.6 Immediately begin monitoring the following measurements.
- The IMU Operate Power is $\pm 28.8 \pm 3$ VDC (CG 1500). Verify on CRT.
 - On the recorders, verify that oscillations are not sustained and that a null is achieved within 10 seconds of power application in 6.2.3.1.5 on the following measurements:

CG 2112, IG IX Resolver Output Sin
CG 2142, MG IX Resolver Output Sin
CG 2172, OG IX Resolver Output Sin
 - On the CRT, verify that the following signals are between +3 to +5 Vrms or -3 to -5 Vrms for a period of approximately 90 sec. After approximately 100 sec the following signals shall be less than ± 1.0 Vrms.

CG 2001 X PIPA SG OUTPUT IN PHASE
CG 2021 Y PIPA SG OUTPUT IN PHASE
CG 2041 Z PIPA SG OUTPUT IN PHASE
 - On the CRT, verify the absence of the +120 VDC PIPA supply (CG 1040) for a period of 90 \pm 10 seconds following power application in 6.2.3.1.5. Verify PIPA fail discrete is present during this period. After approximately 100 seconds, the voltage shall read $\pm 120 \pm 6$ Vdc.
 - Stop the analog recorders.
- 6.2.3.1.7 Insure that the following alarm lamps are not lighted on G&N LEB Display Panel.
- CMC Warning
 - ISS Warning
 - PGNS Caution
- 6.2.3.1.8 Verify that the PROGRAM ALARM lamp on the DSKY's does not light.
- 6.2.3.1.9 The OG, IG, and MG CDU angles shall be 00000 \pm 00150. Verify on CRT.
- 6.2.3.1.10 Enter the following into K-148:
- VERB 41 NOUN 20, ENTER
 - +00000, ENTER
 - +00000, ENTER
 - +00000, ENTER
- 6.2.3.1.11 Verify that the following secondary power supply voltages are not flashing on the CRT display.

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TABLE VI. SECONDARY POWER SUPPLY VOLTAGES

| Meas. No. | Signal |
|-------------|----------------------------|
| 1. CG 1041 | +120 VDC PIPA SUPPLY |
| 2. CG 1051 | +20 VDC PIPA SUPPLY |
| 3. CG 1052 | -20 VDC PIPA SUPPLY |
| 4. CG 1070 | +4 VDC CDU SUPPLY |
| 5. CG 1100 | -28 VDC ELECTRONICS |
| 6. CG 1021 | +14 VDC CMC SUPPLY |
| 7. CG 1030 | +4 VDC CMC SUPPLY |
| 8. CG 1201 | IMU 28V 800 CPS 1 pct 0 ph |
| 9. CG 1202 | IMU 28V 800 CPS 5 pct ph A |
| 10. CG 1203 | IMU 28V 800 CPS 5 pct ph B |
| 11. CG 1331 | 3.2KC 28V SUPPLY |
| 12. CG 1110 | 2.5 VDC TM BIAS |

NOTE: The IMU platform should not be moved during the Temperature Control Test. The IMU platform should be moved after the test.

- 6.2.3.1.12 The IMU Platform should not be moved during the Temperature Control Test. 15 minutes after the application of IMU OPERATE power record PIPA TEMP (CG 2300) displayed on the CRT.
- 6.2.3.1.14 1 hour after the application of IMU OPERATE power monitor and record PIPA TEMP (CG 2300) every 5 minutes for 1 hour. Verify that each reading does not deviate from the average of each signal by more than 0.1° F.
- 6.2.3.1.15 When 2 hours have elapsed since the application of IMU OPERATE power record PIPA TEMP. PIPA TEMP shall be 130.5±1.5° F. PIPA TEMP shall be within 0.5° F of that recorded in 6.2.3.1.12 and 6.2.1.3.8.4.
- 6.2.3.2 Optics Power ON
- 6.2.3.2.1 Optics power shall be applied by actuating the G&N OPTICS MN A and OPTICS MN B breakers on the Right Hand Circuit Breaker Panel (breakers pushed in), and placing G/N Power - OPTICS switch on the LEB Lighting Control Panel to ON.
- 6.2.3.2.2 OPTICS +28 VDC discrete shall be issued (CG 1533). Verify by observing that the OPTICS lamp on Event Module is illuminated. Verify that the +28 VDC OPTX OPERATE BUS (CG 1530) is +28.8±3 VDC. Record the indication on the CRT.

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- 6.2.3.2.3 Verify the following secondary power supply voltages on the CRT are not flashing:
- CG 1211 OPTX 28V 800 CPS 1 pct 0 ph
CG 1212 OPTX 800 CPS 5 pct-90 ph
- 6.2.3.2.3.1 Set/verify OPTICS MODE on the G&N Indicator Control Panel to MAN.
- 6.2.3.2.3.2 Set the OPTICS ZERO switch on the G&N Indicator Panel to ZERO. Wait 10 seconds.
- 6.2.3.3 IMU Cage Test
- 6.2.3.3.1 Enter the following into the DSKY:
- a. VERB 40 NOUN 20, ENTER (wait 3 seconds)
 - b. VERB 41 NOUN 20, ENTER
 - c. +00200, ENTER
 - d. +00200, ENTER
 - e. +00200, ENTER
- Observe that the NO ATT lamps on the DSKY's light and that CDUX, CDUY, CDUZ on the CRT indicate approximately +00200.
- 6.2.3.3.2 Set up the Analog Recorder to monitor the following signals:
- a. IG 1X Resolver Output Sine (CG 2112)
 - b. MG 1X Resolver Output Sine (CG 2142)
 - c. OG 1X Resolver Output Sine (CG 2172)
- Start the Analog Recorders.
- 6.2.3.3.3 On MDC panel 1, press and hold the IMU CAGE switch in the CAGE position. On the Analog Recorder, verify that the 1X Sine signals (CG 2112, CG 2142, and CG 2172) null out at 0.5V rms or less.
- 6.2.3.3.4 Release the IMU CAGE switch. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Sustained oscillations shall be cause for immediate removal of IMU OPERATE power.
- 6.2.3.3.5 On the CRT verify that CDUX, CDUY and CDUZ are all between +00150 and +35850.
- 6.2.3.3.6 Stop the Analog Recorders.
- 6.2.4 G&N System Power Supplies Test

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- 6.2.4.1 Proceed with this test if 6.2.3, Operate Power On Test, has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding with this test. Insure that the IMU Operate Power has been on for at least 15 minutes before proceeding with this test.
- 6.2.4.2 Enter the following sequence into the K-Start. Verb 41 NOUN 20, ENTER; +00000 ENTER; +00000 ENTER; +00000 ENTER.
- 6.2.4.3 Set/Verify the following circuit breakers and switches on the Right Hand Circuit Breakers Panel and LEB.
- COMPUTER MN A to ON (pushed in) and COMPUTER MN B to OFF (pulled out).
 - G/N - POWER to AC1
 - IMU HTR MN A to ON (pushed in) and IMU HTR MN B to OFF (pulled out).
 - IMU MN A to ON (pushed in) and IMU MN B to OFF (pulled out).
 - G/N POWER - IMU to IMU
 - OPTICS MN A to ON (pushed in) and OPTICS MN B to OFF (pulled out).
 - G/N POWER - OPTICS to OPTICS
- 6.2.4.4 Record the voltage indicated on the CRT for the following signals:
- The +28 VDC IMU OPERATE (Buss No. 1) output voltage shall be $\pm 28.8 \pm 3$ VDC (CG 1500).
 - The +28 VDC IMU STANDBY (Buss No. 2) output voltage shall be $\pm 28.8 \pm 3$ VDC (CG 1510).
 - The +28 VDC CMC OPERATE (Buss No. 3) output voltage shall be $\pm 28.8 \pm 3$ VDC (CG 1520).
 - The +28 VDC OPTX OPERATE (Buss No. 4) output voltage shall be $\pm 28.8 \pm 3$ VDC (CG 1530).
 - The CG 2221, IGA CDU Coarse Error measurement shall be 0.0 ± 0.68 Vrms.
 - The CG 2251 MGA CDU Coarse Error measurement shall be 0.0 ± 0.68 Vrms.
 - The CG 2281 OGA CDU Coarse Error measurement shall be 0.0 ± 0.68 Vrms.
- 6.2.4.5 Record the voltage indicated on the CRT for the following power supplies:
- The +120 VDC PIPA Power Supply output voltage shall be 120 ± 6 VDC (CG 1040).
 - The +20 VDC PIPA Power Supply output voltage shall be 20.0 ± 1.2 VDC (CG 1051).
 - The -20 VDC PIPA Power Supply output voltage shall be -20 ± 2 VDC (CG 1052).
 - The -28 VDC Electronics Power Supply output voltage shall be -28.5 ± 6.0 VDC (CG 1100).

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- 6.2.4.6 The following values shall be measured with the guidance reference clock synchronizing input pulse. Record the voltage indicated on the CRT.
- IMU 28V, 800 CPS 1% 0 deg voltage shall be 28.0 ± 0.6 VAC (CG 1201)
 - IMU 28V, 800 CPS, 5% PHA - 90 deg. voltage shall be 28.0 ± 1.4 VAC (CG 1202).
 - IMU 28V, 800 CPS, 5% PHB 0 deg. voltage shall be 28.0 ± 2.1 VAC (CG 1203).
 - Optics 28V, 800 CPS 1% 0 deg voltage shall be 28.0 ± 0.6 VAC (CG 1211).
 - Optics 28V, 800 CPS 5% -90 deg voltage shall be 28.0 ± 1.5 VAC (CG 1212).
 - PH Diff IMU 5% 0 deg. -90 deg. (CG 1207) phase difference shall be $-90^\circ \pm 10^\circ$.
 - PH Diff Optics 1% IMU 1% (CG 1220) phase difference shall be $0^\circ \pm 10^\circ$.
- 6.2.4.7 Record the voltages indicated on the CRT for the following power supplies:
- The +14 VDC CMC Power Supply output voltage shall be $+14.0 \pm 0.4$ VDC (CG 1020).
 - The +4 VDC CMC Power Supply output voltage shall be $+4.0 \pm 0.2$ VDC (CG 1030).
 - The +4 VDC CDU Power Supply output voltage shall be $+4.0 \pm 0.2$ VDC (CG 1070).
 - The +2.50 VDC TM BIAS SUPPLY output voltage shall be $+2.50 \pm 0.05$ VDC (CG 1110).
- 6.2.4.8 Record the CRT indications for the following measurements:
- The 28V, 3200 CPS Power Supply feedback output voltage shall be 28.6 ± 0.6 V RMS (CG 1331).
 - The phase difference between the 3.2 Kc supply and CMC sync shall be $0^\circ \pm 10^\circ$ (CG 1336).
 - The +14 VDC CMC Power Supply rms noise shall be less than 1.0 vrms (CG 1021).
 - The +4 VDC CMC Power Supply rms noise shall be less than 1.0 vrms (CG 1031).
- 6.2.4.9 Set/Verify the following circuit breakers and switches on the Right Hand Circuit Breaker Panel and LEB:
- G/N POWER-OPTICS to OFF
 - OPTICS MN B to ON (pushed in) and OPTICS MN A to OFF (pulled out)
 - G/N POWER - IMU to OFF
 - IMU MN B to ON (pushed in) and IMU MN A to OFF (pulled out).
 - IMU HTR MN A to OFF (pulled out)
 - G/N - POWER to OFF
 - COMPUTER MN B to ON (pushed in) and COMPUTER MN A to OFF (pulled out)

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- 6.2.4.10 Verify that the +28 VDC CMC OPERATE output voltage is +28.8±3 VDC (CG 1520).
- 6.2.4.11 Set the G/N - POWER switch on the LEB to AC2. Set the IMU HTR MN B to ON (pushed in). Verify that the +28 VDC IMU STANDBY output voltage is +28.8±3 VDC (CG 1500).
- 6.2.4.12 Wait until 15 minutes have elapsed since setting G/N POWER - IMU to OFF in 6.2.4.9.c then set the G/N POWER - IMU to IMU. Verify that the +28 VDC IMU OPERATE output voltage is +28.8±3 VDC (CG 1500).
- 6.2.4.13 Set the G/N POWER - OPTICS to OPTICS. Verify that the +28 VDC OPTX OPERATE output voltage is +28.8±3 VDC (CG 1530).
- 6.2.4.14 Repeat 6.2.4.5 through 6.2.4.8.
- 6.2.4.15 Set the following circuit breakers to the position indicated:
- a. Set the COMPUTER MN A to ON (pushed in).
 - b. Set the IMU HTR MN A to ON (pushed in).
 - c. Set the IMU MN A to ON (pushed in).
 - d. Set the OPTICS MN A to ON (pushed in).
- 6.2.4.16 Miscellaneous Checks - The following miscellaneous signals are required to supply data for system evaluation in the event of failure, or for trend analysis of system performance. Record the values displayed on the CRT for the following signals.
- a. CG 4300 CMC Temperature
 - b. CG 6020 PIPA Calibration Module Temperature
 - c. CG 6021 IMU 800 CPS 5% Temperature
- 6.2.4.17 Verify and record the following signals displayed on the CRT:
- a. +120 VDC PIPA SUP NOISE RMS shall be less than 1.5 VRMS (CG 1042).
 - b. +20 VDC PIPA SUP NOISE RMS shall be less than 1.0 VRMS (CG 1053)
 - c. +4 VDC CDU SUP NOISE RMS shall be less than 1.0 VRMS (CG 1071).
 - d. +28V IMU OPERATE BUS NOISE RMS shall be less than 1.0 VRMS (CG 1501)
 - e. +28V IMU STANDBY BUS NOISE RMS shall be less than 1.0 VRMS (CG 1511).
 - f. +28V CMC OPERATE BUS NOISE RMS shall be less than 2.0 VRMS (CG 1521)
 - g. +28V OPTX OPERATE BUS NOISE RMS shall be less than 2.0 VRMS (CG 1531).
- 6.2.4.18 The noise peaks of the following signals are demonstrated on the event light when the peaks have a rise time between 2 and 50 usec and the peak voltage exceeds 5 volts.

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| a. +14V CMC SUPPLY NOISE PEAKS | | (CG 1022) |
| b. +4V CMC SUPPLY NOISE PEAKS | | (CG 1032) |
| c. +120 VDC PIPA SUPPLY NOISE PEAKS | | (CG 1043) |
| d. +4 VDC CDU SUPPLY NOISE PEAKS | | (CG 1072) |
| e. +28V IMU OPERATE BUS NOISE PEAKS | | (CG 1502) |
| f. +28V IMU STANDBY BUS NOISE PEAKS | | (CG 1512) |
| g. +28V CMC OPERATE NOISE PEAKS | | (CG 1522) |
| h. +28V OPTX OPERATE NOISE PEAKS | | (CG 1532) |
| 6.2.4.19 | If Optics Testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF. | |
| 6.2.5 | <u>General Turn Off and Turn On Procedure</u> | |
| | NOTE: The procedure shall be utilized any time after performing 6.2.1, Standby Power On Test and 6.2.3, Operate Power On Test to turn on or turn off the G&N Systems. Appropriate portions of this procedure will be referenced in other tests. | |
| 6.2.5.1 | Turn Off Procedure. | |
| | CAUTION: This procedure must be performed in the sequence specified. Failure to adhere to this sequence may require calibration of the inertial components. | |
| 6.2.5.1.1 | Enter the following sequence into the K-148. | |
| | a. VERB 41 NOUN 20, ENTER | |
| | b. +00000 ENTR | |
| | c. +00000 ENTR | |
| | d. +09000 ENTR | |
| | Verify that the GIMBAL LOCK indicator on the DSKY's is illuminated. On the G&N Indicator Control Panel verify PGNS light is ON. On the DSKY verify NO ATT light is ON. | |
| 6.2.5.1.2 | Set the following switches on the G&N Indicator Control Panel to the positions designated. | |
| | a. OPTICS ZERO to ZERO | |
| | b. OPTICS MODE to MANUAL | |
| | c. OPTICS COUPLING to DIRECT | |
| | d. OPTICS SPEED to MED | |
| | e. OPTICS TEL TRUN to SLAVE to SXT | |
| | f. RETICLE BRIGHTNESS to minimum brightness position | |
| 6.2.5.1.3 | Set the G/N Power - IMU switch on the LEB Lighting Control Panel to OFF and G&N IMU MN A and MN B circuit breakers on the Right Hand Circuit Breaker panel to OFF (breakers pulled out). | |

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- 6.2.5.1.3.1 On K-148 enter the following:
- | | | |
|---------|---------|--------------|
| VERB 21 | NOUN 01 | ENTER |
| 00034 | | ENTER |
| 00000 | | ENTER, ENTER |
| 00760 | | ENTER |
| 40000 | | ENTER |
- Verify that NO ATT and GIMBAL LOCK lamp indications are OFF.
- 6.2.5.1.4 Set the G&N Power AC1-OFF-AC2 Switch on the Right Hand Circuit breaker panel to OFF and the G&N POWER AC1 and AC2 circuit breakers to OFF (breakers pulled out).
- 6.2.5.1.5 Decrease the LIGHTS - NUMERICS controls on both the Left Hand Circuit Breaker panel and the LAB Lighting Control Panel to the minimum brightness - OFF position.
- 6.2.5.1.6 Set the PSAAM power switch on the PSAAM to OFF.
- 6.2.5.1.7 Set the IMU HTR MN A and MN B circuit breaker on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).
- 6.2.5.1.8 Set the G/N POWER - OPTICS switch on the LEB Lighting Control Panel to OFF and G&N OPTICS MN A and MN B breakers on the Right, Hand Circuit breaker panel to OFF.
- 6.2.5.1.9 Set the COMPUTER MN A and MN B Circuit breakers on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).
- 6.2.5.1.10 Verify that the PTC is supplying inertial components heater power to the G&N System. This will be indicated by the following on the PTC.
- G&N ON (PTC inhibit) light not illuminated.
 - IMU Temp/heater current meter indicates IMU temperature of $130^{\circ} \pm 5^{\circ} \text{F}$.
- 6.2.5.2 Turn ON Procedure
- 6.2.5.2.1 Set or verify the following G&N Indicator Control Panel switches to the position indicated.
- CONDITION LAMPS to ON
 - OPTICS ZERO to ZERO
 - OPTICS MODE to MANUAL
 - OPTICS COUPLING to DIRECT
 - OPTICS SPEED to LO
 - OPTICS TEL TRUN to SLAVE to SXT
 - RETICLE BRIGHTNESS to minimum brightness position.
- 6.2.5.2.2 Insure that interfacing system EPS and ECS are turned on and operating properly.
- CAUTION: The remaining procedure must be followed in sequence specified. Failure to adhere to this sequence may require recalibration of the inertial components.

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- 6.2.5.2.3 Energize the G&N COMPUTER MN A and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Press the STBY pushbutton on the DSKY for approximately 3 seconds. Verify +14 and +4 VDC AGC power supply outputs on CRT display. Voltages shall be $+14 \pm 0.4V$ (CG1020) and $+4 \pm 0.2$ (CG1030). On DSKY verify TEMP light is ON. On the G&N Indicator Control Panel verify PGNS light is ON.
- 6.2.5.2.4 Set the G&N POWER AC1 and AC2 breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in). Set the G&N POWER AC1-OFF-AC2 switch to AC1.
- 6.2.5.2.4.1 Set the G&N DSKY and Display Panel brightness to the minimum acceptable level by manipulation of LIGHTS - NUMERICS control on both Left Hand Circuit breaker panel and LEB Lighting Control panel.
- 6.2.5.2.5 Energize the G&N IMU HTR, MN A and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Insure that the CMC +28 VDC discrete lamp on the Event Module is illuminated (CG 1523). Verify TEMP light on DSKY is extinguished. Verify PGNS light on the G&N Indicator Control Panel is extinguished.
- 6.2.5.2.5.1 Set/Verify the following switches on the PSAAM.
- 6.2.5.2.6 Enter VERB 36 into K148. Press ENTER pushbutton. Press ERROR RESET pushbutton on K148. All computer alarms except the Gimbal Lock Indicator on the Main Display Console (MDC) and LEB AGC DSKY shall clear. Verify registers R1, R2, and R3 on the DSKY's are cleared. Verify PROG = 00.
- 6.2.5.2.7 Clear the CMC erasable memory by entering the following sequence into the K-Start.
- VERB 92, press ENTER
 - 00015, press ENTER
- 6.2.5.2.8 Initiate CMC self-check by entering the following sequence into the K-Start:
- VERB 21 NOUN 27, ENTER
 - 77777, ENTER
 - VERB 15 NOUN 01, ENTER
 - 1366, ENTER
- 6.2.5.2.8.1 Monitor DSKY until R3 (SCOUNT +2) increment twice. If an error is detected, the PROGRAM ALARM lamp on the DSKY's shall light.
- 6.2.5.2.8.2 Terminate the monitor routine by entering the following into the DSKY:
VERB 34, ENTER.

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6.2.5.2.8.3 Enter the following into the K-Start:

- a. VERB 21
- b. NOUN 27 ENTER
- c. 00000, ENTER

NOTE: Allow 2 hours to elapse before proceeding to 6.2.5.2.9 with the following exceptions:

- a. If the G&N System has been in the power off state for less than 5 days with the gimbals in the parked position (0°, 0', 90°) and the system has not been moved, allow 15 minutes to elapse before proceeding.
- b. If the G&N System has been turned off with the gimbals in the unparked position for less than 2 hours allow a warmup time equal to the time off but not less than 15 minutes to elapse before proceeding.

CAUTION: If the requirements of 6.2.5.2.10 are not met, remove IMU Operate Power immediately by setting the G/N POWER-IMU switch on the LEB Lighting Control Panel to OFF.

6.2.5.2.9 After the required warmup time has elapsed set the G&N IMU MN A and MN B circuit breaker on the Right Hand circuit breaker panel to ON (breaker pushed in), and the G/N POWER - IMU switch on the LEB Lighting Control panel to the IMU position (toggle up).

6.2.5.2.10 Immediately begin monitoring the following measurements.

- a. On the CRT verify that IMU Operate Power is $+28.8 \pm 3$ VDC (CG 1500).
- b. On the meter modules verify that oscillations are not sustained and that a null is achieved within 10 seconds of power application on the following measurements:

| | |
|---------|---------------------------|
| CG 2112 | IG 1X Resolver Output Sin |
| CG 2142 | MG 1X Resolver Output Sin |
| CG 2172 | OG 1X Resolver Output Sin |

- c. On the CRT verify the absence of the +120 VDC PIPA Supply (CG 1040) for a period of 90 ± 10 seconds following power application. After approximately 100 seconds, the voltage shall read $+120 \pm 6$ VDC.

6.2.5.2.11 Verify that the PROGRAM ALARM lamp on the DSKY's does not light.

6.2.5.2.12 Enter and verify VERB 40, NOUN 20 into K148. Press the ENTER pushbutton.

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- 6.2.5.2.13 Enter and verify VERB 41, NOUN 20 into K148. Press the ENTER pushbutton to advance the System to the Coarse Align mode. The VERB-NOUN display on the CRT shall flash and indicate 21-22.
- 6.2.5.2.14 Enter and verify +00000 into K148 three times, pressing the ENTER pushbutton on the K-START after each entry.
- 6.2.5.2.15 Set the G&N OPTICS MN A and MN B circuit breakers on the Right Hand Circuit breaker panel to the ON position (breaker pushed in).

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6.2.5.2.16 Verify that the CRT indications of the signals in Table VI are not flashing.

Table VI. Secondary Power Supply Voltages

| Measurement Number | Signal |
|--------------------|-----------------------------|
| 1 CG 1040 | +120 VDC PIPA SUPPLY |
| 2 CG 1051 | +20 VDC PIPA SUPPLY |
| 3 CG 1052 | -20 VDC PIPA SUPPLY |
| 4 CG 1070 | +4 VDC CDU SUPPLY |
| 5 CG 1100 | -28 VDC ELECTRONICS |
| 6 CG 1020 | +14 VDC CMC SUPPLY |
| 7 CG 1030 | +4 VDC CMC SUPPLY |
| 8 CG 1201 | IMU 28V 800 CPS 1 pct 0 pha |
| 9 CG 1202 | IMU 28V 800 CPS 5 pct ph A |
| 10 CG 1203 | IMU 28V 800 CPS 5 pct ph B |
| 11 CG 1331 | 3.2 KC 28V SUPPLY |
| 12 CG 1110 | 2.5 VDC TM BIAS |
| 13 CG 2301 | IRIG TEMPERATURE |

6.2.5.2.17 Monitor the PIPA Display Scope to insure that each PIPA is moding properly.

6.2.5.2.18 Perform 6.2.6 G&N Operational Test.

6.2.6 G&N Operation Test

6.2.6.1 Initial Conditions

6.2.6.1.1 Deleted.

6.2.6.1.2 Enter the following into KI48.

- a. VERB 01 NOUN 10, ENTER
- b. 00003, ENTER

Record R1 = AAAAA and Range Time.

6.2.6.1.3 Enter the following into KI48.

- a. VERB 21 NOUN 02, ENTER
- b. 02100, ENTER
- c. AAAAA, ENTER
- d. VERB 06 NOUN 02, ENTER
- e. 02100, ENTER

Record R1 = BBBBB

6.2.6.1.4 Perform the following calculations:

- a. $\frac{(BBBBB) \times 5.12}{3600} = CC.C$ (hours in high order scalar channel 3)
- b. $23.3 - CC.C = DD.D$ hours
- c. DD.D plus the time of day recorded in 6.2.6.1.2 = the time at which the high order scalar, channel 3, will overflow.

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Do not enter the G&N Operational Test within 12 minutes of the time calculated in 6.2.6.1.4.c. If the test is in process at this time, undesirable results will occur.

6.2.6.2 Test Initiation

6.2.6.2.1 Enter VERB 92 into K148. Press the ENTER pushbutton.

6.2.6.2.2 Enter 00004 into K148. Press the ENTER pushbutton.

6.2.6.2.3 The NO ATT discrete shall appear momentarily then go OFF. Verify that the PROGRAM display on the CRT indicates 07.

NOTE: During this portion of the test the G&N System is exercised through its modes. Any failure will be indicated by the PROGRAM ALARM lamp on the DSKY's lighting.

6.2.6.2.4 After approximately 12 minutes, VERB 06, NOUN 98 will flash and the value of the gravity vector in cm/sec^2 shall be displayed in R1 and R2 on the CRT. Record these values.

6.2.6.2.5 R1 contains the first five digits of the gravity vector and R2 contains the last five digits. A decimal point shall be between them. The value for the gravity vector shall be $980.00000 \pm 05.00000 \text{ cm/sec}^2$.

6.2.6.2.6 Enter VERB 33 into K148. Press the ENTER pushbutton.

6.2.6.2.7 When VERB 06 NOUN 98 flashes the value of the horizontal earth rate shall be displayed in R1 and R2 on the CRT. Record these values.

6.2.6.2.8 R1 contains the first five digits of earth rate and R2 contains the last five digits. A decimal point shall be placed between them. R1 shall always be 00000. The horizontal earth rate shall be 00000.88000 ± 0.1000 earth rate units.

6.2.6.3 Test Termination

6.2.6.3.1 Enter VERB 36 into K148. Press the ENTER pushbutton.

6.2.6.3.2 Enter VERB 41, NOUN 20 into K148. Press the ENTER pushbutton.

6.2.6.3.3 Enter +00000 into K148 three times. Press the ENTER pushbutton after each entry.

6.2.7 Gimbal Friction Test

6.2.7.1 Deleted.

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6.2.7.1.1 Enter the following into the K-START:

| | | |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +17000 | ENTER | |
| +17000 | ENTER | |
| +17000 | ENTER | |

6.2.7.1.2 Verify on the CRT that R1 = +17000, R2 = +17000 and R3 = +17000. Wait 15 seconds and enter the following into the K-START:

| | | |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +27000 | ENTER | |
| +27000 | ENTER | |
| +27000 | ENTER | |

6.2.7.1.3 Verify on the CRT that R1 = +27000, R2 = 27000 and R3 = 27000. Wait 15 seconds and enter the following:

| | | |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +00000 | ENTER | |
| +00000 | ENTER | |
| +00000 | ENTER | |

6.2.7.1.4 Verify on the CRT that R1 = +00000, R2 = +00000 and R3 = +00000. Wait 15 seconds before proceeding.

6.2.7.2 Inner Gimbal Friction Test

6.2.7.2.1 Setup the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):

| | |
|------------|---------------------------|
| a. CG 2120 | IG TORQUE MOTOR CURRENT |
| b. CG 2117 | IGA SERVO ERROR IN PHASE |
| c. CG 2112 | IG 1X RESOLVER OUTPUT SIN |
| d. CG 2113 | IG 1X RESOLVER OUTPUT COS |
| e. CG 2220 | IGA CDU FINE ERROR |
| f. CG 2221 | IGA CDU Coarse Error |

6.2.7.2.2 Enter the following sequence into the K-Start, pushing the ENTER pushbutton after each entry (+360 IG torquing).

| |
|---------------------------|
| a. VERB 24 NOUN 01, ENTER |
| b. 01155, ENTER |
| c. 40000, ENTER |
| d. 40034, ENTER |

Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.

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- 6.2.7.2.3 Enter the following sequence into K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (verify VERB 33 on CRT)
- 6.2.7.2.4 Start analog recorders.
- 6.2.7.2.5 Verify that IG Servo Error Quadrature (CG 2108) is 0.0 ± 1.2 Vrms. Observe measurement CG 2112, IG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.
- 6.2.7.2.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- VERB 40, NOUN 20, press ENTER
 - VERB 41, NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
- 6.2.7.2.7 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.2.8 Enter the following sequence into the K-Start. Push the ENTER push button after each entry (-360° IG torquing):
- VERB 24 NOUN 01 ENTER
 - 01153, ENTER
 - 37777, ENTER
 - 37743, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.2.9 Enter the following sequence into K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (verify VERB 33 on CRT).
- 6.2.7.2.10 Start analog recorders.
- 6.2.7.2.11 Observe measurement CG 2112, IG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.

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6.2.7.2.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.

- VERB 40, NOUN 20, press ENTER
- VERB 41, NOUN 20, press ENTER
- +0^000, press ENTER
- +00000, press ENTER
- +00000, press ENTER

6.2.7.2.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.

6.2.7.3 Outer Gimbal Friction Test.

6.2.7.3.1 Setup the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):

- CG 2180 OG TORQUE MOTOR CURRENT
- CG 2177 OGA SERVO ERROR IN PHASE
- CG 2172 OG 1X RESOLVER OUTPUT SIN
- CG 2173 OG 1X RESOLVER OUTPUT COS
- CG 2280 OGA CDU FINE ERROR
- CG 2281 OGA CDU Coarse Error

6.2.7.3.2 Enter the following sequence into the K-Start. Pushing the ENTER push-button after each entry (+360° OG torquing):

- VERB 24 NOUN 01, ENTER
- 01153, ENTER
- 40000, ENTER
- 40034, ENTER

Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.

6.2.7.3.3 Enter the following sequence into K-Start:

- VERB 42, press ENTER
- VERB 33, press ENTER (verify VERB 33 on CRT)

6.2.7.3.4 Start analog recorders

6.2.7.3.5 Observe measurement CG 2172, OG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.
 Observe the CRT for the following sequence:

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- 6.2.7.3.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- VERB 40, NOUN 20, press ENTER
 - VERB 41, NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
- 6.2.7.3.7 Verify that OG Servo Error Quadrature (CG 2168) is 0.0±1.2 Vrms. Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.3.8 Enter the following sequence into the K-Start. Push the ENTER pushbutton after each entry (-360° OG torquing):
- VERB 24 NOUN 01, ENTER
 - 01158, ENTER
 - 37777, ENTER
 - 37743, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.3.9 Enter the following sequence into K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (verify VERB 33 on CRT)
- 6.2.7.3.10 Start analog recorders.
- 6.2.7.3.11 Observe measurement CG 2172, OG 1X resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorder.
- 6.2.7.3.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start:
- VERB 40, NOUN 20, press ENTER
 - VERB 41, NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - 06750, press ENTER
- 6.2.7.3.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = -06750. Wait 30 seconds before proceeding.

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- 6.2.7.4 Middle Gimbal Friction Test.
- 6.2.7.4.1 Setup the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):
- a. CG 2150 MG TORQUE MOTOR CURRENT
 - b. CG 2147 MGA SERVO ERROR IN PHASE
 - c. CG 2142 MG 1X RESOLVER OUTPUT SIN
 - d. CG 2143 MG 1X RESOLVER OUTPUT COS
 - e. CG 2250 MGA CDU FINE ERROR
 - f. CG 2251 MGA CDU Coarse Error
- 6.2.7.4.2 Enter the following sequence into the K-Start. Push the ENTER pushbutton after each entry (+135° MG torquing):
- a. VERB 24, NOUN 01, ENTER
 - b. 01157, ENTER
 - c. 03777, ENTER
 - d. 77777, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.4.3 Enter the following sequence in the K-Start:
- a. VERB 42, press ENTER
 - b. VERB 33, press ENTER (Verify VERB 33 on CRT)
- 6.2.7.4.4 Start the analog recorder.
- 6.2.7.4.5 Verify that MG Servo Error Quadrature (CG 2138) is 0.0 ± 1.2 Vrms.
- 6.2.7.4.6 Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs (approximately 5 minutes), stop the recorders.
- 6.2.7.4.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- a. VERB 40 NOUN 20, ENTER
 - b. VERB 41 NOUN 20, press ENTER
 - c. +00000, press ENTER
 - d. +00000, press ENTER
 - e. +06750, press ENTER

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- 6.2.7.4.7 Enter the following sequence into the K-Start. Push ENTER pushbutton after each entry (-135° MG torquing):
- VERB 24 NOUN 01, ENTER
 - 01157, ENTER
 - 14000, ENTER
 - 00000, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.4.8 Enter the following sequence in the K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (Verify VERB 33 on CRT)
- 6.2.7.4.9 Start analog recorders.
- 6.2.7.4.10 Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When the steady-state condition occurs (approximately 5 minutes), stop the recorders.
- 6.2.7.4.11 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- VERB 40 NOUN 20, press ENTER
 - VERB 41 NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
- 6.2.7.5 Examine the traces of the recorded measurements for all six phases of this test to detect any sharp discontinuities. Disregard transients of 0.5 second duration or less on the Gimbal Torque motor current traces, and those less than 0.2 second on the CDU fine error measurement traces. The Gimbal Torque motor currents shall not exceed 0.125 amperes. The CDU Fine Error measurements shall not exceed ±70 mv rms. The CDU Coarse Error measurement shall not exceed ±680 mv rms.

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- 6.2.8 G&N Panel Brightness and Lamp Test.
- 6.2.8.1 Proceed with this test if 6.2.5.2 or 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2 before proceeding with this test.
- 6.2.8.2 Rotate the RETICLE BRIGHTNESS thumbwheel on the Control Indicator Panel and verify the capability to control the illumination of the following lamps:
- a. SCT reticles
 - b. SKT reticles
 - c. Telescope Panel Angle Counters
- 6.2.8.3 Turn on LIGHTS-INTEGRAL control on Left Hand Circuit Breaker panel and LEB Lighting Control Panel.
- 6.2.8.4 Adjust the brightness controls on the LEB Lighting Control Panel and Left Hand Circuit Breaker Panel from minimum brightness to maximum brightness. Verify the operation of the G&N Indicator Control Panel lamps.
- 6.2.8.4.1 Re-adjust brightness controls for minimum acceptable lighting. Turn off LIGHTS-INTEGRAL control on Left Hand Circuit Breaker panel and LEB Lighting Control Panel.
- 6.2.8.5 Push and hold the CONDITION LAMPS switch on the G&N Indicator Control Panel to TEST. Verify the illumination of the following lamps:
- a. STAR ACQ
 - b. MASTER ALARM lamp
- 6.2.8.6 Set the CONDITION LAMPS switch to ON. Lamps a and b in 6.2.8.5. shall extinguish.

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| 6.2.9 | | |
| Semi-Automatic Moding Check | | |
| Proceed with this test if 6.2.3 has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 before proceeding with this test. | | |
| 6.2.9.1 | | |
| Test Initiation | | |
| 6.2.9.1.1 | | |
| Set the G/N POWER-OPTICS switch on the LEE Lighting Control Panel to OPTICS. Verify OPTX BUS, 28V 800 ~ 1% and 5% Power Supplies. | | |
| 6.2.9.1.2 | | |
| Enter VERB 92 into K148. Press the ENTER pushbutton. | | |
| 6.2.9.1.3 | | |
| Enter 00010 into K148. Press the ENTER pushbutton. | | |
| 6.2.9.1.4 | | |
| After approximately 5 seconds observe VERB 06 NOUN 01 flashing on the CRT and Program display indicates 07. | | |
| 6.2.9.2 | | |
| Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall light. After approximately 30 seconds the following data shall be displayed on the CRT: | | |
| a. VERB 06 NOUN 02 flashing | | |
| b. R1 = +00000 ± 00007 | | |
| c. R2 = +00000 ± 00007 | | |
| d. R3 = +00000 ± 00007 | | |
| e. IG angle = 000 ± 3 deg. | | |
| f. MG angle = 000 ± 3 deg. | | |
| g. OG angle = 000 ± 3 deg. | | |
| 6.2.9.3 | | |
| Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT. | | |
| a. VERB 06 NOUN 03 flashing | | |
| b. R1 = +04500 ± 00007 | | |
| c. R2 = +04500 ± 00007 | | |
| d. R3 = +04500 ± 00007 | | |
| e. IG angle = 045 ± 3 deg. | | |
| f. MG angle = 045 ± 3 deg. | | |
| g. OG angle = 045 ± 3 deg. | | |
| 6.2.9.4 | | |
| Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT. | | |
| a. VERB 05 NOUN 97 flashing | | |
| b. R1 = 00000 ± 00003 | | |
| c. R2 = 00000 ± 00003 | | |
| d. R3 = 00000 ± 00003 | | |
| NOTE: Negative numbers will be displayed in octal complement form, i.e., -00001 = 77776. | | |

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- 6.2.9.5 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS Caution lamp on the Indicator Control Panel shall light.
- a. VERB 06 NOUN 05 flashing
 - b. R1 = +07100 ± 00007
 - c. R2 = +07100 ± 00007
 - d. R3 = +07100 ± 00007
 - e. IG angle = 071 ± 3 deg.
 - f. MG angle = 071 ± 3 deg.
 - g. OG angle = 071 ± 3 deg.
- The GIMBAL LOCK lamps on the DSKY's shall light.
- 6.2.9.6 Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 06 Flashing
 - b. R1 = +09000 ± 00007
 - c. R2 = +09000 ± 00007
 - d. R3 = +09000 ± 00007
 - e. IG angle = 090 ± 3 deg.
 - f. MG angle = 090 ± 3 deg.
 - g. OG angle = 090 ± 3 deg.
- 6.2.9.7 Enter VERB 33 and Press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 07
 - b. R1 = +13500 ± 00007
 - c. R2 = +13500 ± 00007
 - d. R3 = +13500 ± 00007
 - e. IG angle = 135 ± 3 deg.
 - f. MG angle = 135 ± 3 deg.
 - g. OG angle = 135 ± 3 deg.
- 6.2.9.8 Enter VERB 33 and press ENTER. After approximately 20 seconds VERB 06 NOUN 8 shall flash. The GIMBAL LOCK lamp shall extinguish on the DSKY's. The PGNS Caution lamp on the Indicator Control Panel shall extinguish. The gimbal angles shall be approximately 135°, 135°, and 45° respectively.
- 6.2.9.9 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.
- a. VERB 05 NOUN 97 flashing.
 - b. R1 = 00000 ± 00003
 - c. R2 = 00000 ± 00003
 - d. R3 = 00000 ± 00003

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| 6.2.9.10 | | |
| <p>Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS caution lamp on the Indicator Control Panel shall light.</p> <p>a. VERB 06 NOUN 10 flashing b. R1 = +22500+00007 c. R2 = +22500+00007 d. R3 = +22500+00007 e. IG angle = 225±3 deg. f. MG angle = 225±3 deg. g. OG angle = 225±3 deg.</p> <p>The GIMBAL LOCK lamp on the DSKY's shall light.</p> | | |
| 6.2.9.11 | | |
| <p>Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS caution lamp on the Indicator Control Panel shall extinguish.</p> <p>a. VERB 06 NOUN 11 flashing b. R1 = +22500+00007 c. R2 = +22500+00007 d. R3 = +31500+00007 e. IG angle = 225±3 deg. f. OG angle = 225±3 deg. g. MG angle = 315±3 deg.</p> <p>The GIMBAL LOCK lamp on the DSKY shall extinguish.</p> | | |
| 6.2.9.12 | | |
| <p>Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.</p> <p>a. VERB 06 NOUN 97 flashing b. R1 = 00000+00003 c. R2 = 00000+00003 d. R3 = 00000+00003</p> | | |
| 6.2.9.13 | | |
| <p>Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT.</p> <p>a. VERB 06 NOUN 13 flashing b. R1 = +31500+00007 c. R2 = +31500+00007 d. R3 = +31500+00007 e. IG angle = 315±3 deg. f. MG angle = 315±3 deg. g. OG angle = 315±3 deg.</p> | | |

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- 6.2.9.14 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately .8 seconds the following data shall be displayed on the CRT.
- a. VERB 05 NOUN 97 flashing
 - b. R1 = 00000+00003
 - c. R2 = 00000+00003
 - d. R3 = 00000+00003
- 6.2.9.15 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately .5 seconds the following data shall be displayed on the CRT. The PGNS Caution lamp on the Indicator Control Panel shall light.
- a. VERB 06 NOUN 15 flashing
 - b. R1 = +28900+00007
 - c. R2 = +28900+00007
 - d. R3 = +28900+00007
 - e. IG angle = 289+3 deg.
 - f. OG angle = 289+3 deg.
 - g. MG angle = 289+3 deg.
- The GIMBAL LOCK lamp on the DSKY's shall light.
- 6.2.9.16 Enter VERB 33 and press ENTER. After approximately 20 seconds the following data will be displayed on the CRT. The PGNS Caution lamp on the Indicator Control Panel shall extinguish.
- a. VERB 06 NOUN 16 flashing
 - b. R1 = +00000+00007
 - c. R2 = +00000+00007
 - d. R3 = +00000+00007
 - e. IG angle = 000+3 deg.
 - f. MG angle = 000+3 deg.
 - g. OG angle = 000+3 deg.
- The GIMBAL LOCK lamp on the DSKY's shall extinguish.
- 6.2.9.17 Enter VERB 33 and press ENTER. The COMP ACTY lamp on the DSKY's shall flash for a few seconds. After approximately 15 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 08 flashing
 - b. R1 = 000xx
 - c. R2 = xxxxx
- The GIMBAL LOCK lamp on the DSKY's shall light. The PGNS Caution lamp on the Indicator Control Panel shall light.
- Record R1 and R2 as the Middle Gimbal CDU drive rate. MG rate = $\frac{R1 - R2}{\text{sec}}$. The Middle Gimbal CDU drive rate shall be 14+2°/sec.

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- 6.2.9.18 Enter VERB 33 into K148. Press the ENTER pushbutton. After approximately 30 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 08 flashing
 - b. R1 = 000xx
 - c. R2 = xxxxx
- The GIMBAL LOCK lamp on the DSKY's shall extinguish. The PGNS Caution lamp on the Indicator Control Panel shall extinguish.
- Record R1 and R2 as the Inner Gimbal CDU drive rate.
IG rate = $\frac{R1}{1442} \cdot \frac{R2}{1442}$ /sec. The Inner Gimbal CDU drive rate shall be 1442" /sec.
- 6.2.9.19 Enter VERB 33 into K148. Press the ENTER pushbutton. After approximately 30 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 08 flashing
 - b. R1 = 000xx
 - c. R2 = xxxxx
- Record R1 and R2 as the Outer Gimbal CDU drive rate.
OG rate = $\frac{R1}{1442} \cdot \frac{R2}{1442}$ /sec. The Outer Gimbal CDU drive rate shall be 1442" /sec.
- 6.2.9.20 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall extinguish. After approximately 20 seconds VERB 21 NOUN 22 shall flash on the CRT. Enter +00100 into K148 three times. Press the ENTER pushbutton after each entry. The NO ATT lamp on the DSKY's shall momentarily light, then extinguish. After approximately 100 seconds VERB 01 NOUN 10 flashing shall be displayed on the CRT. Press the ENTER pushbutton.
- Enter 00030 into K148. Press the ENTER pushbutton. Verify R1 = 33xxx.
- The ISS WARNING Lamp on the Indicator Control Panel shall light.
The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be ON.
- 6.2.9.21 Enter VERB 33 into K148. Press the ENTER pushbutton. ISS WARNING and ISS CDU FAIL shall be OFF. After approximately 20 seconds VERB 21 NOUN 22 shall flash on the CRT. Enter +03375 into K148 three times. Press the ENTER pushbutton after each entry. The NO ATT lamp on the DSKY's shall momentarily light, then extinguish. After approximately 100 seconds VERB 01 NOUN 10 flashing shall be displayed on the CRT. Press the ENTER pushbutton.
- Enter 00030 into K148. Press the ENTER pushbutton.
Verify R1 = 33xxx.
- The ISS WARNING lamp on the Indicator Control Panel shall light.
The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be ON.

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- 6.2.9.22 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DEKY's shall light. After approximately 20 seconds VERB 06 NOUN 91 shall flash on the CRT. The ISS WARNING lamp on the Control Indicator Panel shall extinguish. The ISS WARNING and ISS CDS FAIL discretes on the CRT shall be OFF.
- 6.2.9.23 Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS MODE switch to CMC.
- 6.2.9.24 Enter VERB 33, press ENTER. After approximately 25 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98 flashing
 - b. R1 = 000xx
 - c. R2 = xxxxx
- Record R1 and R2 as the Shaft Optics CDU drive rate.
Shaft rate = $\frac{R1}{R2}$. The Shaft Optics CDU drive rate shall be $15.10 \pm 3.78^\circ/\text{sec}$.
- 6.2.9.25 Enter VERB 33 into K148. Press the ENTER pushbutton. In about 15 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98
 - b. R1 = 0000x
 - c. R2 = xxxxx
- Record R1 and R2 as the Trunnion Optics CDU drive rate. Trunnion rate = $\frac{R1}{R2}$. The Trunnion Optics CDU drive rate shall be $3.77 \pm 0.94^\circ/\text{sec}$.
- 6.2.9.26 Terminate the Semi-Automatic Moding Check by entering VERB 34 into K148. Observe PROG display on DEKY's is 00. Press the ENTER pushbutton. If Optics testing will not continue, set the G/N POWER-OPTICS switch on the L&E Lighting Panel to OFF.

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6.2.10 Zero Optics Test

6.2.10.1 Set the G&N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.

NOTE: Proceed with this test if 6.2.3 Operate Power on test has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2. Turn On Procedure before proceeding.

INITIALIZATION

6.2.10.2 Insure that the following switches on the G&N Indicator Control Panel are set as follows:

- OPTICS TEL TRUN to SLAVE to SXT
- OPTICS COUPLING to DIRECT
- OPTICS SPEED to HI
- OPTICS MODE to MAN

OPTICS ZERO MODE TEST

6.2.10.3 Monitor the Optics CDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton.

6.2.10.4 Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Verify the Optics have zeroed properly by observing the following on R1 and R2 of the CRT.

- $R1 = +0.00^\circ \pm 0.02^\circ, -0.03^\circ$ (Shaft Angle)
- $R2 = +0.000^\circ \pm 0.006^\circ, -0.007^\circ$ (Trunnion Los Angle)

6.2.10.4.1 Enter the following:

VERB 01 NOUN 10, ENTER
00033 ENTER

Verify R1 = XXX6X

6.2.10.4.2 Set the OPTICS ZERO switch to OFF and the OPTICS MODE switch to CMC. Enter the following:

ENTER
00033, ENTER

Verify R1 = XXX5X

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| 6.2.10.4.3 | Set the OPTICS MODE switch to MAN. Press the KEY-REL pushbutton. | | | | | | | | | | |
| OPTICS TIME TO ZERO TEST | | | | | | | | | | | |
| 6.2.10.5. | Set up the Analog Recorder to monitor the following measurements. | | | | | | | | | | |
| | <ul style="list-style-type: none"> a. CG 3140 SXT Shaft Tach Output b. CG 3150 SXT Trunnion Tach Output c. CG 3160 SCT Shaft Tach Output d. CG 3170 SCT Trunnion Tach Output e. CG 3117 SXT Shaft Servo Error in phase f. CG 3118 SXT Trunnion Servo Error in phase g. CG 3145 SXT Shaft MTR control winding h. CG 3155 SXT Trunnion MTR control winding | | | | | | | | | | |
| 6.2.10.6 | Push the Optics Hand Controller to the right, driving the SXT Shaft until R1 on the CRT indicates $+180 \pm 1^\circ$. Push the Optics Hand Controller up, driving the SXT Trunnion until R2 on the CRT indicates $+75 \pm 1^\circ$. | | | | | | | | | | |
| 6.2.10.7 | Start the Analog Recorders and set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. | | | | | | | | | | |
| 6.2.10.8 | Monitor the Analog Recorders until all signals return to null. Stop the Analog Recorders. The elapsed time between the initial and final SXT Shaft and Trunnion Tach output null shall be less than 15 seconds. The peak magnitude of the SXT Shaft (CG 3140) and Trunnion (CG 3150) Tach Outputs shall be -3.3 ± 1.3 V rms. The peak magnitude of the SCT Shaft Tach Output (CG 3160) shall be $+3.3 \pm 1.3$ V rms. The peak magnitude of the SCT Trunnion Tach Output (CG 3170) shall be 0.85 ± 0.35 V rms. The SXT SHAFT (CG 3117) and TRUNNION (CG 3118) Servo Error In Phase measurements shall each have a maximum magnitude of 2 VRMS. The peak magnitude of the SXT SHAFT (CG 3145) and TRUNNION (CG 3155) MTR Control Winding measurements shall be 0.85 ± 0.35 VRMS. | | | | | | | | | | |
| 6.2.10.9 | Record R1 and R2 on the CRT. The data displayed shall be as follows: | | | | | | | | | | |
| | <ul style="list-style-type: none"> a. $+0.00^\circ$ $+0.02^\circ$, -0.03° (Shaft Angle) b. $R2 = +0.000$ $+0.006^\circ$, -0.007° (Trunnion LOS Angle) | | | | | | | | | | |
| 6.2.10.10 | Record the Telescope Panel Angle Counter Indications. The Shaft Angle shall be 0.0 ± 0.11 degrees. The Trunnion Angle shall be 0.0 ± 0.22 degrees. | | | | | | | | | | |
| 6.2.10.11 | Set the G/N Power Optics switch on the LEB Lighting Control Panel to OFF. | | | | | | | | | | |

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OPTICS BACKUP MODE TEST

- 6.2.10.12 Insert the Inflight Tool (V36601405) into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eyepiece while turning the tool until the TPAC reads +5°. Remove the tool from the Trunnion tool input.
- 6.2.10.13 Insert the Inflight Tool (V36601405) into the Shaft Tool input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool.
- 6.2.10.14 Insert the Inflight Tool (V36601405) into the Trunnion Tool input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool.
- 6.2.11 OPTICS Coordinate Transformation Control Test.
- 6.2.11.1 Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.
- NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding.
- #### INITIALIZATION
- 6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.
- OPTICS TEL TRUN to SLAVE to EXT
 - OPTICS COUPLING to DIRECT
 - OPTICS SPEED to HI
 - OPTICS MODE to MAN
- 6.2.11.3 Enter the following into the K-Start to monitor the OPTICS CDU's.
- VERB 16 NOUN 91, press ENTER
- 6.2.11.3.1 Perform the following to set the "MARKING SYSTEM IN USE" bit of EXTVBACT register.
- 6.2.11.3.1.1 Enter the following into the K-Start:
- VERB 01 NOUN 01, ENTER
 - 00766, ENTER
- Record R1 = XXXXY

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6.2.11.3.1.2 Enter the following into the K-Start:

- VERB 21 NOUN 01, ENTER
- 00766, ENTER
- XXXXY', ENTER where Y' is determined from Table I and XXXX is that recorded in 6.2.11.3.1.1.

TABLE I

| Y (from 6.2.11.3.1.1) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------------------|---|---|---|---|---|---|---|---|
| Y' | 2 | 3 | 2 | 3 | 6 | 7 | 6 | 7 |

6.2.11.4 Set the OPTICS ZERO switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS ZERO switch to OFF.

6.2.11.5 Set up the analog recorders to monitor the following measurements:

- CG 3170 SCT Trunnion Tachometer Output

RESOLVED MODE PHASING AND IMAGE RATE TEST.

6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until R1 = +225.00 and R2 = +10.000 on the CRT and the DSKY's.

6.2.11.7 Set the OPTICS COUPLING switch on the G&N Panel to RSLV and the OPTICS Speed switch to MED.

6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern, then start the analog recorders.

6.2.11.9 Quickly displace the OPTICS CONTROL STICK 45±10 degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at 45±10 deg. When Target leaves the SCT upper right field of view press MARK pushbutton. Press the KEY REL pushbutton and immediately record the shaft angle as displayed on R1 of the DSKY. The recorded shaft angle shall be +225±10.00 degrees.

6.2.11.10 Stop the analog recorder and measure the elapsed time between the initial and the final signal null conditions for the Trunnion measurement. The elapsed time shall be from 19 to 32 seconds.

CSC AMPLIFIER SHAFT AND TRUNNION DRIVE TEST

6.2.11.11 Set the OPTICS COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the optics until R1 = +225.00 and R2 = +10.000. Set the OPTICS COUPLING switch to RSLV.

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| 6.2.11.12 | | | | | | | | |
| While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view. | | | | | | | | |
| 6.2.11.13 | | | | | | | | |
| Set the OPTICS COUPLING switch on the G&N Panel to DIRECT. Set the OPTICS ZERO switch to ZERO. | | | | | | | | |
| 6.2.11.13.1 | | | | | | | | |
| Perform the following to remove the "MARKING SYSTEM IN USE" bit of EXTVBACT registers. | | | | | | | | |
| 6.2.11.13.1.1 | | | | | | | | |
| Enter the following into the K-Start: | | | | | | | | |
| a. VERB 01 NOUN 01, ENTER | | | | | | | | |
| b. 00766, ENTER | | | | | | | | |
| Record R1 = XXXXY | | | | | | | | |
| 6.2.11.13.1.2 | | | | | | | | |
| Enter the following into the K-Start: | | | | | | | | |
| a. VERB 21 NOUN 01, ENTER | | | | | | | | |
| b. 00766, ENTER | | | | | | | | |
| c. XXXXY' ENTER where Y' is determined from Table II and XXXX is that recorded in 6.2.11.13.1.1. | | | | | | | | |
| TABLE II | | | | | | | | |
| Y (from 6.2.11.13.1.1) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Y' | 0 | 1 | 0 | 1 | 4 | 6 | 4 | 5 |
| NOTE: If optics testing will not continue, set the G/N POWER OPTICS switch on the LEB Lighting Control Panel to OFF. | | | | | | | | |
| 6.2.12 | | | | | | | | |
| OPTICS FUNCTIONAL TEST | | | | | | | | |
| 6.2.12.1 | | | | | | | | |
| Deleted. | | | | | | | | |
| 6.2.12.2 | | | | | | | | |
| Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following: | | | | | | | | |
| a. +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8±3 VDC. Record the indication on the CRT. | | | | | | | | |
| b. CG 1211 OPTX 28V 800 cps ±1% 0 ph not flashing on CRT. | | | | | | | | |
| c. CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT. | | | | | | | | |

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- 6.2.12.7.2 Set/Verify following switches on G&N INDICATOR CONTROL PANEL:
- OPTICS TEL TRUN - SLAVE to SXT
 - OPTICS COUPLING - DIRECT
 - OPTICS SPEED - HI
- 6.2.12.7.3 Monitor OCDU's by entering VERB 16 NOUN 91 into K-148. Press ENTER.
- 6.2.12.7.4 Set OPTICS MODE to MAN.
- 6.2.12.7.5 Using the Optics Hand Controller drive the optics until:
- R1 = +000.00±001.00 (SHAFT)
R2 = +10.000±01.000 (TRUNNION)
- 6.2.12.7.6 Verify on the CRT and Optics Panel:
- SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.7 Set the OPTICS TEL TRUN on the G&N INDICATOR CONTROL PANEL to 0°.
- 6.2.12.7.8 Verify:
- SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = 0.0° ±0.22 DEG
- R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.9 Set the OPTICS TEL TRUN on the G&N INDICATOR CONTROL PANEL to OFFSET 25°.
- 6.2.12.7.10 Verify on CRT and Optics Panel:
- SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = 25° ±0.22 DEG
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.11 On the G&N INDICATOR CONTROL PANEL set the OPTICS TEL TRUN to SLAVE to SXT.
- 6.2.12.7.12 Verify on CRT and Optics Panel:
- SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = R2 ±0.22 DEG

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| 6.2.12.7.13 | On the G&N INDICATOR CONTROL PANEL set the OPTICS ZERO to ZERO. Wait 15 sec. | | | | | | | | | | |
| 6.2.12.7.14 | Verify on CRT and OPTICS PANEL: | | | | | | | | | | |
| | R1 = 000.00+000.02, -000.03 | | | | | | | | | | |
| | R2 = 00.000+00.006, -00.007* | | | | | | | | | | |
| | SHAFT TPAC = R1 ± 0.11 DEG | | | | | | | | | | |
| | TRUN TPAC = R2 ± 0.22 DEG | | | | | | | | | | |
| 6.2.12.7.15 | If Optics testing will not be continued, set the G&N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF. | | | | | | | | | | |
| 6.2.12.8 | SXT Parallelism Tests | | | | | | | | | | |
| 6.2.12.8.1 | Remove the plug from the base of the SXT eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light. | | | | | | | | | | |
| | NOTE: If needed to reduce external light, place a photographers hood over the optics head. | | | | | | | | | | |
| 6.2.12.8.2 | SXT Auto Collimator Parallelism Test - MSO only. | | | | | | | | | | |
| 6.2.12.8.2.1 | Using the OPTICS CONTROL STICK drive the SXT StLOS Trunnion to $+15.00^\circ \pm 2^\circ$ as indicated in R2 of the DSKY. Maintain a Shaft CDU angle of 000.00 ± 0.10 degrees. | | | | | | | | | | |
| 6.2.12.8.2.2 | Sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to superimpose the SXT LLOS horizontal reticle image upon the autocollimator horizontal filar. Record the autocollimator reading. | | | | | | | | | | |
| 6.2.12.8.2.3 | Repeat 6.2.12.8.2.2 twice. Calculate and record the average of the three autocollimator readings. | | | | | | | | | | |
| 6.2.12.8.2.4 | Set the OPTICS ZERO switch to ZERO. After 15 seconds return the OPTICS ZERO switch to OFF. Set the OPTICS MODE switch to MAN. | | | | | | | | | | |
| 6.2.12.8.2.5 | Again sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to bring the SXT StLOS horizontal reticle and autocollimator horizontal filar images to coincide. Record the autocollimator reading. | | | | | | | | | | |

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- 6.2.12.8.2.6 Repeat 6.2.12.8.2.5 twice. Calculate and record the average of the three autocollimator readings. The average value obtained here shall not differ from that obtained in 6.2.12.2.3 by more than 10 arc seconds.
- 6.2.12.8.3 SXT TRUN 90° Positional Accuracy Test
- 6.2.12.8.3.1 Obtain Portable Light Assembly and Adapter Assembly. Remove the plug from base of SXT Eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light. Set OPTICS MODE switch to MAN. Set OPTICS ZERO switch to OFF.
- 6.2.12.8.3.2 Using the OPTICS CONTROL STICK drive the SXT Trunnion angle to $85.000^\circ \pm 5^\circ$ as indicated on R2 of the DSKY. Set the OPTICS SPEED to LO and drive the SXT Trunnion to $+90.000^\circ \pm 0.100^\circ$ as indicated on R2 of the DSKY. Insure that the SXT Shaft angle remains at 000.00 ± 0.10 degrees as indicated by R1 on the DSKY.
- 6.2.12.8.3.3 Sight through the SXT. Two reticle patterns shall be visible. Use the OPTICS CONTROL STICK to adjust the SXT Trunnion angle until the two horizontal reticle lines are coincident. Record the Trunnion CDU angle displayed in R2. The Trunnion CDU angle shall be 90.000 ± 0.010 degrees.
- 6.2.12.8.3.4 Remove the Portable Light Assembly and Adapter Assembly from the base of the SXT eyepiece. Replace the SXT eyepiece plug.
- NOTE: If Optics testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.9 SXT, CMC Function Check
- 6.2.12.9.1 Set the OPTICS MODE switch to MAN. Set the OPTICS ZERO switch to ZERO. After 15 seconds, return the switch to OFF.
- 6.2.12.9.2 Sight through the SXT. Using the Control Stick align the SXT StLOS with Optical Target No. 1.

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- 6.2.12.9.3 When aligned, record the value of the Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.4 Sight through the SXT. Using the Control Stick align the SXT StLOS with Optical Target No. 2.
- 6.2.12.9.5 When aligned, record the value of the Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.6 Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. After 15 seconds set the OPTICS ZERO switch to OFF. Set the OPTICS MODE switch to CMC.
- 6.2.12.9.7 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.3 into the DSKY and press ENTER. Enter the value for Trunnion from 6.2.12.9.3 into the DSKY and press ENTER.
- 6.2.12.9.8 Sight through the SXT. The StLOS should be approximately centered on the Optical Target No. 1. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.3 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.9 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton. Enter the value for Trunnion from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton.
- 6.2.12.9.10 Sight through the SXT. The StLOS should be approximately centered on the Optical Target No. 2. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.11 Set the OPTICS ZERO switch to ZERO. Wait 15 seconds.
- 6.2.12.9.12 If OPTICS testing will not continue, set the G&N Power Optics switch on the LEB Lighting Panel to OFF.

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- 6.2.13 Optics Slew Rate Test.
- 6.2.13.1 Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following signals on the CRT.
- a. +28 VDC OPTICS OPERATE BUS (CG 1530) is $+29.0 \pm 3.0$ VDC.
 - b. CPTX 28V 800 cps 1% 0° ph not flashing on the CRT.
 - c. OPTX 28V 800 cps 5% -90° ph not flashing on the CRT.
- 6.2.13.1.1 Verify and/or set the following switches on the G&N Indicator Control Panel to the positions indicated:
- a. OPTICS TEL TRUN to SLAVE to SXT
 - b. OPTICS COUPLING to DIRECT
 - c. OPTICS SPEED to HI
 - d. OPTICS MODE to MAN.
- 6.2.13.2 Monitor the OCDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton. Insure RECORD DSKY and RECORD DOWNLINK on R-145 are ON.
- 6.2.13.3 Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch on the G&N Indicator Panel to OFF. Set the OPTICS MODE switch to MAN.
- NOTE: Read and understand step 6.2.13.4 before proceeding. Do not hold Control Stick at upper limit more than 10 seconds or exceed a trunnion angle of 85°.
- TRUNNION SLEW RATE - HI SPEED
- 6.2.13.4 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 7 seconds release the control stick.
- 6.2.13.5 Perform the following calculations:
- From the Uplink file tape, the compressed data tape or the PCM tape request a data reduction of the trunnion CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the rate test was being performed.
- Calculate the slew rate by dividing the Δ CDU angle by the elapsed time.
- The Trunnion slew rate shall be 10.0 ± 2.0 deg/sec.

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| SHAFT SLEW RATE - HI SPEED | | |
| 6.2.13.6 | | |
| Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. | | |
| NOTE: Read and understand step 6.2.13.7 before proceeding. Do not hold Control Stick at right limit for more than 10 seconds or exceed a shaft angle of 250°. | | |
| 6.2.13.7 | | |
| Record time. Push and hold the Optics Control stick to its right limit. After approximately 7 seconds release the control stick. | | |
| 6.2.13.8 | | |
| Perform the following calculations: | | |
| From the uplink file tape, the compressed data tape or the PCM tape, request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the rate test was being performed. | | |
| Calculate the rate by dividing the ΔCDU angle by the elapsed time. | | |
| The Shaft slew rate shall be 19.5±3.9 deg/sec. | | |
| TRUNNION SLEW RATE - MED SPEED | | |
| 6.2.13.9 | | |
| Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS SPEED switch to MED. | | |
| NOTE: Read and understand 6.2.13.10 before proceeding. Do not hold control stick at upper limit for more than 20 seconds. | | |
| 6.2.13.10 | | |
| Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick. | | |
| 6.2.13.11 | | |
| Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick. | | |

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- 6.2.13.11 Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU registers (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Trunnion slew rate shall be 1.0 ± 0.2 deg/sec.
- SHAFT SLEW RATE - MED SPEED
- 6.2.13.12 Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.
- NOTE: Read and understand 6.2.13.13 before proceeding. Do not hold control stick at right limit for more than 20 seconds.
- 6.2.13.13 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.
- 6.2.13.14 Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Shaft slew rate shall be 2.0 ± 0.4 deg/sec.
- TRUNNION SLEW RATE - LO SPEED
- 6.2.13.15 Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS SPEED switch to LO.
- NOTE: Read and understand 6.2.13.16 before proceeding. Do not hold control stick at upper limit for more than 30 seconds.

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6.2.13.16 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.

6.2.13.17 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Trunnion slew rate shall be 0.10 ± 0.02 deg/sec.

SHAFT SLEW RATE - LO SPEED

6.2.13.18 Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.

NOTE: Read and understand 6.2.13.18 before proceeding. Do not hold control stick at right limit for more than 20 seconds.

6.2.13.19 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.

6.2.13.20 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Shaft slew rate shall be 0.20 ± 0.04 deg/sec.

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OPTICS HAND CONTROLLER DRIFT RATE CHECK - LO SPEED

- 6.2.13.21 Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Record time. Wait 60 seconds.
- 6.2.13.22 Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion and Shaft CDU registers (addresses 35 and 36 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 60 second period during which the drift rate test was being performed.
- Calculate the drift rate by dividing the Δ CDU angles by the elapsed time.
- The Trunnion drift rate shall be less than .0167 deg/sec.
- The Shaft drift rate shall be less than .0333 deg/sec.
- 6.2.13.23 If OPTICS testing will not continue; set the G/N Power-Optics switch on the LEB Lighting Control Panel to OFF.

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| 6.2.14 | Stabilization Loop Step Response Test. | | | | | | |
| 6.2.14.1 | Proceed with this test if the Operate Power On Test of 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform the Turn On Procedure of 6.2.5.2 before proceeding. | | | | | | |
| 6.2.14.2 | Insure that the Carry-on Command Stimuli Unit, Model No. C14-200, is installed and connected. | | | | | | |
| 6.2.14.3 | Enter VERB 36 into K148. Press the ENTER pushbutton, then the ERROR RESET pushbutton. | | | | | | |
| 6.2.14.4 | Inner Gimbal Response Test. | | | | | | |
| 6.2.14.4.1 | Enter code 2032000000 in C-START Module 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2117 IGA SERVO ERROR on 4A1-A3-CH1. | | | | | | |
| 6.2.14.4.2 | Enter VERB 41 NOUN 20 into K148. Press ENTER pushbutton. | | | | | | |
| 6.2.14.4.3 | Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds. | | | | | | |
| 6.2.14.4.4 | Enter VERB 42 into K148. Press ENTER. | | | | | | |
| 6.2.14.4.5 | Enter +00000 into K148 three times. Press ENTER after each entry. Wait 90 seconds. | | | | | | |
| 6.2.14.4.6 | Enter 0001 into R154. Verify and execute to apply +28 VDC ACE ENABLE to the PSAAM. | | | | | | |
| 6.2.14.4.7 | Enter 1000 into R155. Verify and execute to enter a DC step into the 1G stabilization loop. | | | | | | |
| CAUTION: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF. | | | | | | | |
| 6.2.14.4.8 | Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec. | | | | | | |
| 6.2.14.4.9 | Enter 0000 into 4A2-A6-R155; the top part of switch should be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the 1G Stabilization Loop. The bottom part of switch shall be extinguished. | | | | | | |
| 6.2.14.4.10 | After the transient has died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots. | | | | | | |

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- 6.2.14.4.10.1 The inner gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.4.10.2 The maximum number of overshoots on the IGA Servo Error signals shall be three.
- 6.2.14.5 Middle Gimbal Response Test.
- 6.2.14.5.1 Enter code 2028000000 into C-START MODULE 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2147 MGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.5.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.5.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.5.4 Enter VERB 42 into K148. Press ENTER.
- 6.2.14.5.5 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 90 seconds.
- 6.2.14.5.6 Enter 0100 into 4A2-A6-R155. The top part of switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.5.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the MG Stabilization Loop.
- CAUTION: If the transient caused by the step input does not die within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the L&B Lighting Control Panel to OFF.
- 6.2.14.5.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.5.9 Enter 0000 into 4A2-A6-R155. The top part of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.
- 6.2.14.5.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.5.10.1 The middle gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.5.10.2 The maximum number of overshoots on the MGA Servo Error signals shall be three.

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- 6.2.14.6 Outer Gimbal Response Test.
- 6.2.14.6.1 Enter code 2026000000 in C-START Module 4A1-A5-C156. Press XEQ/SEAL Pushbutton to call up XG 2177 OGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.6.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.6.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.6.4 Enter VERB 42 into K148. Press ENTER pushbutton.
- 6.2.14.6.5 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 90 seconds.
- 6.2.14.6.6 Enter 0010 into 4A2-A6-R155. The top half of the switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.6.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the OG Stabilization Loops.
- NOTE: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.6.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.6.9 Enter 0000 into 4A2-A6-R155. The top half of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the OG Stabilization Loop.
- 6.2.14.6.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.6.10.1 The outer gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.6.10.2 The maximum number of overshoots on the OGA Servo Error Signals shall be three.
- 6.2.14.7 Enter VERB 40 NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.14.7.1 Enter VERB 41 NOUN 20 into K148. Press the ENTER pushbutton.

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- 6.2.14.7.2 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.3 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.4 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.5 Enter 0000 into R154. Verify and execute to remove +28 VDC ACE ENABLE.

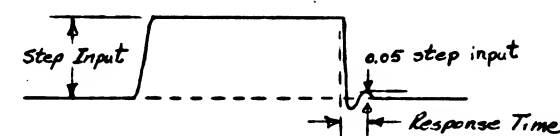


Figure 1. Typical Step Input Response

- 6.2.15 IRIG Scale Factor Test
- 6.2.15.1 Perform Master Initialization 6.2.5.3 before proceeding.
- 6.2.15.2 Verify that the IMU OPERATE power has been applied for a minimum of 1 hour, and that at least 1 hour has elapsed since running of the Gimbal Friction Test, 6.2.7.
- 6.2.15.3 Set up the Analog Recorders to monitor the following signals:
 - a. CG 2117 IG SERVO ERROR
 - b. CG 2147 MG SERVO ERROR
 - c. CG 2177 OG SERVO ERROR
 - d. CG 2120 IG TM CURRENT
 - e. CG 2150 MG TM CURRENT
 - f. CG 2180 OG TM CURRENT
- 6.2.15.3.1 Start the analog recorder chart drive using a chart speed of 1 mm/sec. The recorder shall run for the duration of 6.2.15.
- 6.2.15.4 Enter VERB 92 into K148. Press the ENTER pushbutton.
- 6.2.15.5 Enter 00005 into K148. Press the ENTER pushbutton. Program 07 shall be displayed.
- 6.2.15.6 VERB 06 NOUN 41 shall flash on CRT and the following displayed in R1 and R2:
 - R1 = +xxxxxx (some Nav. Base azimuth)
 - R2 = +xxxxxx (some test site latitude; see Table I)

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6.2.15.7 If the values displayed in R1 and R2 are correct, proceed with test, if not perform the following sequence:

- a. To correct R1, on the K-Start enter VERB 21, press ENTER pushbutton, $\pm xxx.xx$, press ENTER ($\pm xxx.xx$ is correct nav. base azimuth).
- b. To correct R2, on the K-Start enter VERB 22, press ENTER pushbutton, $\pm xx.xxx$, press ENTER (obtain correct site latitude from Table I).

Verify that the values in R1 and R2 are correct.

TABLE I

| SITE | LATITUDE |
|------------|----------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC MSO | +28.523 |
| KSC VAB | +28.585 |
| KSC PAD 39 | +28.607 |

6.2.15.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00001 ENTR

NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.8.

6.2.15.9 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+X IRIG Scale Factor error in part per million, Position +00001).

6.2.15.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00002 ENTR

NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.10.

6.2.15.11 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor Error in parts per million Position +00002).

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6.2.15.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00003 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step, or
PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat
steps 6.2.15.4 through 6.2.15.7 and 6.2.15.12.

6.2.15.13 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and
record from CRT DSKY Row 1 (-Z IRIG Scale Factor error in parts per
million, Position +00003).

6.2.15.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
-00001 ENTR

NOTE: If PROG lamp changes from 06 to 00 during the next step, or
PROG ALARM lamp is on, enter VERB 38 ENTR and repeat
steps 6.2.15.4 through 6.2.15.7 and 6.2.15.14.

6.2.15.15 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and
record from CRT DSKY Row (-X IRIG Scale Factor error in parts per
million, Position -00001).

6.2.15.16 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
-00002 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step, or
PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat
steps 6.2.15.4 through 6.2.15.7 and 6.2.15.16.

6.2.15.17 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and
record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per
million, Position -00002).

6.2.15.18 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
-00003 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step on
PROG ALARM is ON, enter VERB 36 ENTR and repeat steps
6.2.15.4 through 6.2.15.7 and 6.2.15.18.

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- 6.2.15.19 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position -00003).
- 6.2.15.20 Repeat steps 6.2.15.8 through 6.2.15.19 twice to obtain second and third set of data.
- 6.2.15.21 Terminate this test by entering in K-148: VERB 34 ENTER
- 6.2.15.22 The average of the three readings of Scale Factor Error for the 6 positions shall be 0 ± 1750 PPM.
- 6.2.15.23 After completion of all test numbers, stop the analog recorders.
- 6.2.15.24 Enter VERB 40 NOUN 20, ENTER into K148.
- 6.2.15.25 Enter the following into K148:
- a. VERB 41 NOUN 20, ENTER
 - b. +00000, ENTER
 - c. +00000, ENTER
 - d. +00000, ENTER
- 6.2.16 IMU Performance Test
- 6.2.16.1 Proceed with this test if the Operate Power On Test of 6.2.3 or the Turn On Procedure of 6.2.5.2 has been completed and system operation has not been interrupted. If the system operation has been interrupted, perform Turn On Procedure of 6.2.5.2 before proceeding with this test.
- 6.2.16.2 Enter VERB 01 NOUN 10 into K148. Press the ENTER pushbutton. Enter 00003 into K148. Press the ENTER pushbutton. Record R1 = AAAAA and the time of day.
- 6.2.16.3 Enter VERB 21 NOUN 02 into K148. Press the ENTER pushbutton. Enter 02100 into K148. Press ENTER. Enter AAAAA into K148. Press ENTER.
- 6.2.16.4 Enter VERB 06 NOUN 02 into K148. Press ENTER. Enter 02100 into K148. Press ENTER. Record R1 = BBBB.
- 6.2.16.5 Perform the following calculations:
- a. $\frac{R1 (BBBB) \times 5.12}{3600} = CCCC.C$ (hrs. in high order scaler channel 3)
 - b. $23.3 - CCC.C = DDDDD$ Hrs.
 - c. Add DDDDD to time of day recorded in step 1.

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Do NOT enter any of the PIPA scale factor tests within -0.2 hours of the time of day calculated in step 6.2.16.5.c This is the time at which the high order scaler, channel 3, will overflow. If a PIPA scale factor test is being performed at this time, unacceptable test results will occur.

- 6.2.16.6 Verify that the IMU Operate Power has been applied for at least one hour.
- 6.2.16.7.1 Deleted.
- 6.2.16.7.2 Deleted.
- 6.2.16.7.4 Enter 00001 into K148. Press the ENTER pushbutton.
- 6.2.16.7.5 On the CRT DSKY display VERB 06 NOUN 41 shall flash. Verify R1 (Nav Base Azimuth) and R2 (Site Latitude) are correct.
- 6.2.16.7.6 If values for R1 and R2 are correct, proceed to next step. If values for R1 and R2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR
±XXX.XX ENTR (Correct navigation base azimuth ±0.50 deg)
±XX.XXX ENTR (Correct site latitude from Table XX)
Verify values in R1 and R2 are correct.

TABLE XX

| LOCATION | LATITUDE |
|----------|----------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC-MSO | +28.523 |
| KSC-VAB | +28.585 |
| KSC-PAD | +28.607 |

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6.2.16.7.7 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.8 On CRT, DSKY display, verify R1 = +00900 (Time),
R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position).
If values for R1, R2 and R3 are correct, proceed to next step. If
values for R1, R2 and R3 are incorrect, enter the following sequence
into K-148:

VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00001 ENTR (Test Position Entry)

6.2.16.7.9 On K-148 enter the following sequence:

VERB 33 ENTR

6.2.16.7.10 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the
CRT DSKY display, record R2 (+NBDY) Position +00001.

6.2.16.7.11 On K-148 enter the following sequence:

VERB 33 ENTR

6.2.16.7.12 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT,
record R1 and R2 (+X PIPAS) Position +00001. Row 1 is whole part, Row
2 is fractional part, Units are cm/sec².

6.2.16.7.13 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.14 On CRT DSKY displays, verify R1 = +00900, R2 = +00000, and R3 = +00002.

If values for R1, R2 and R3 are correct, proceed to next step. If values
for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00002 ENTR (Test Position Entry)

6.2.16.7.15 On K-148 enter the following sequence:

VERB 33 ENTR

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- 6.2.16.7.16 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (+NBDZ) position +00002.
- 6.2.16.7.17 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.2.16.7.18 In approximately 90 secs. VERB 06 NOUN 98 shall flash. From the CRT, record R1 and R2 (-X PIPAG) Position +00002.
- 6.2.16.7.19 On K-148 enter the following sequence:
- VERB 21 NOUN 01 ENTR
01155 ENTR
77757 ENTR
VERB 21 NOUN 01 ENTR
01157 ENTR
00020 ENTR
VERB 33 ENTR
- 6.2.16.7.20 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (-NBDX + ADIAX) Pos. +00002. Record CRT CDU gimbal angle indications and time.
- 6.2.16.7.21 On K-148 enter the following sequence:
- VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.22 On CRT, DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00003.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00003 ENTR (Test Position Entry)
- 6.2.16.7.23 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.2.16.7.24 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (-NBDX) Position +00003.
- 6.2.16.7.25 On K-148 enter the following sequence:
- VERB 33 ENTR

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6.2.16.7.26 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2 (+Z PIPAG) Position +00003.

6.2.16.7.27 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.28 On the CRT, DSKY display verify R1 = +00900, R2 = 00000, and R3 = +00004.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00004 ENTR (Test Position Entry)

6.2.16.7.29 On K-148 enter the following sequence:

VERB 33 ENTR

6.2.16.7.30 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (+NBDY + ADSRAY) Position +00004.

6.2.16.7.31 On K-148 enter the following sequence:

VERB 33 ENTR

6.2.16.7.32 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2 (-Z PIPAG) Position +00004.

6.2.16.7.33 On K-148 enter the following sequence:

VERB 21 NOUN 01 ENTR
01153 ENTR
00020 ENTR
VERB 21 NOUN 01 ENTR
01155 ENTR
77757 ENTR
VERB 33 ENTR

6.2.16.7.34 In approximately 67 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display record R2 (+NBDZ + ADIAZ) Position +00004. Record CRT CDU gimbal angle indications and time.

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6.2.16.7.35 On K-148 enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.36 From the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00005

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00005 ENTR (Test Position Entry)

6.2.16.7.37 Record Time. On K-148 enter the following sequence:

VERB 33 ENTR

6.2.16.7.38 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset. The PROG alarm shall extinguish.

6.2.16.7.39 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2 (+Y PIPAG) Position +00005.

6.2.16.7.40 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.41 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00006.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2, and R3 are incorrect, enter the following sequence into K-148.

VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00006 ENTR (Test Position Entry)

6.2.16.7.42 Record Time. On K-148 enter the following sequence:

VERB 33 ENTR

6.2.16.7.43 The PROG Alarm and GIMBAL LOCK lamps shall light. Press Error Reset. The PROG alarm lamp shall extinguish.

6.2.16.7.44 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2. (-Y PIPAG) Position +00006.

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- 6.2.16.7.45 On K-148 enter the following sequence:
- VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.46 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00007.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2, and R3 are incorrect, enter the following sequence into K-148:
- VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00007 ENTR (Test Position Entry)
- 6.2.16.7.47 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.2.16.7.48 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (+.707 ADSRAX-NBDX) Position +00007.
- 6.2.16.7.49 On K-148 enter the following sequence:
- VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.50 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00008.
- 6.2.16.7.51 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.2.16.7.52 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 [-.707 (NBDZ + NBDY) +.05 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] . Position +00008.
- 6.2.16.7.53 On K-148 enter the following:
- VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.54 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00009.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00009 ENTR (Test Position Entry)

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| 6.2.16.7.55 | On K-148 enter the following sequence: VERB 33 ENTR | | | | | | | | | | |
| 6.2.16.7.56 | In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADSRAZ) Position +00009. | | | | | | | | | | |
| 6.2.16.7.57 | On K-148 enter the following sequence: VERB 34 ENTR VERB 06 NOUN 98 shall flash | | | | | | | | | | |
| 6.2.16.7.58 | On the CRT DSKY display, verify R1 = +00900; R2 = +00000, and R3 = +00010. If values for R1, R2, and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148: VERB 25 ENTR +00900 ENTR (Test Time in Seconds) +00000 ENTR (Test Index Number) +00010 ENTR (Test Position Entry) | | | | | | | | | | |
| 6.2.16.7.59 | On K-148 enter the following sequence: VERB 33 ENTR | | | | | | | | | | |
| 6.2.16.7.60 | In approximately 12 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display record R2 [707 (NBDY - NBDX) +.5 (ADLAY - ADIAX) +.5 ADSRAZ] Position +00010. | | | | | | | | | | |
| 6.2.16.7.61 | Terminate this test by entering in K-148 the following: VERB 36 ENTR | | | | | | | | | | |
| 6.2.16.7.62 | On K-148 enter the following sequence: VERB 41 NOUN 20 ENTR +00000 ENTR +00000 ENTR +00000 ENTR | | | | | | | | | | |
| 6.2.16.8 | Deleted | | | | | | | | | | |
| 6.2.16.9 | Deleted | | | | | | | | | | |
| 6.2.16.10 | Calculations | | | | | | | | | | |

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TABLE XXI

| Position No. as Displayed in R3 | Quantity Being Measured |
|------------------------------------|--|
| +00001 | +NBDY +X PIPA G |
| +00002 | +NBDZ -X PIPA G -NBDX + ADIAX |
| +00003 | -NBDX +Z PIPA G |
| +00004 | +NBDY + ADSRAY -Z PIPA G +NBDZ + ADIAZ |
| +00005 | +Y PIPA G |
| +00006 | -Y PIPA G |
| +00007 | -NBDX + .707 ADSRAX |
| +00008 | .707 (NBDZ - NBDY) +.5 (ADIAZ - ADIAY) +.5 (ADSRAY + ADSRAZ) |
| +00009 | -NBDZ + .707 ADSRAZ |
| +00010 | .707 (NBDY - NBDX) +.5 (ADIAZ - ADIAX) +.5 (ADSRAX) |

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| 6.2.16.10.1 Measured Values | | | | | |
|---|----------------|--------------|----------|---|----------------|
| | Line | Position No. | Step No. | Parameter | Recorded Value |
| | 6.2.16.10.1.1 | 1 | +00001 | 6.2.16.7.10 +NBDY | R2 |
| | 6.2.16.10.1.2 | 2 | +00001 | 6.2.16.7.12 +XPIPAG | R1 • R2 |
| | 6.2.16.10.1.3 | 3 | +00002 | 6.2.16.7.16 +NBDZ | R2 |
| | 6.2.16.10.1.4 | 4 | +00002 | 6.2.16.7.18 -X PIPAG | R1 • R2 |
| | 6.2.16.10.1.5 | 5 | +00002 | 6.2.16.7.20 -NBDX + ADIAX | R2 |
| | 6.2.16.10.1.6 | 6 | +00003 | 6.2.16.7.24 -NBDX | R2 |
| | 6.2.16.10.1.7 | 7 | +00003 | 6.2.16.7.26 +ZPIPAG | R1 • R2 |
| | 6.2.16.10.1.8 | 8 | +00004 | 6.2.16.7.30 +NBDY + ADSRAY | R2 |
| | 6.2.16.10.1.9 | 9 | +00004 | 6.2.16.7.32 -ZPIPAG | RL • R2 |
| | 6.2.16.10.1.10 | 10 | +00004 | 6.2.16.7.34 +NBDZ + ADIAZ | R2 |
| | 6.2.16.10.1.11 | 11 | +00005 | 6.2.16.7.39 +YPIPAG | R1 • R2 |
| | 6.2.16.10.1.12 | 12 | +00006 | 6.2.16.7.44 -YPIPAG | RL • R2 |
| | 6.2.16.10.1.13 | 13 | +00007 | 6.2.16.7.48 -NBDX + .707 ADSRAX | R2 |
| | 6.2.16.10.1.14 | 14 | +00008 | 6.2.16.7.52 .707 (-NBDZ-NBDY) +.5 (ADIAX-ADIAZ) +.5 (ADSRAY + ADSRAZ) | R2 |
| | 6.2.16.10.1.15 | 15 | +00009 | 6.2.16.7.56 -NBDZ + .707 ADSRAZ | R2 |
| | 6.2.16.10.1.16 | 16 | +00010 | 6.2.16.7.60 .707 (NBDY - NBDX) +.5 (ADIAZ - ADIAX) +.5 ADSRAX | R2 |
| 6.2.16.10.1.17 Y PIPA Data Correction Calculation. | | | | | |
| 6.2.16.10.1.17.1 From the uplink file tape, the compressed data tape or the PCM tape, request a data reduction of the X and Z accelerometer ΔV counts (addresses 37 and 41 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the period during which the Y PIPA test was being performed in positions 5 and 6 of the IMU Performance test. | | | | | |
| 6.2.16.10.1.17.2 Perform the following calculations for position 5. | | | | | |
| $G'_5 = \frac{G_5}{\cos \theta_{G_5}}$ | | | | | |
| where: | | | | | |
| G ₅ = Measured acceleration term (line 11) | | | | | |
| G' ₅ = Corrected acceleration term | | | | | |

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6.2.16.10.1.17.2
(Continued)

$$\cos \theta_{y5} = \frac{1 - \frac{1}{2} \theta_{y5}^2}{\theta_{y5}^2} \text{ for small angles}$$

$$\theta_{y5} = \sqrt{\theta_{x5}^2 + \theta_{z5}^2}$$

and:

$$\theta_{z5} = (\Delta V_{x5} - \Delta V_x \text{ Bias}) (S.F._x) / (\Delta T) \text{ (local g)}$$

$$\theta_{x5} = (\Delta V_{z5} - \Delta V_z \text{ Bias}) (S.F._z) / (\Delta T) \text{ (local g)}$$

and:

$$V_x \text{ Bias} = (X \text{ PIPA Bias}) (\Delta T) / S.F._x$$

$$V_z \text{ Bias} = (Z \text{ PIPA Bias}) (\Delta T) / S.F._z$$

S.F. and Bias terms are obtained from positions 1 through 4 of the IMU Performance Test.

6.2.16.10.1.17.3 Perform the following calculations for position 6.

$$G'_6 = \frac{G_6}{\cos \theta_{y6}}$$

Where:

G_6 = Measured acceleration term (line 12)

G'_6 = Corrected acceleration term

$$\cos \theta_{y6} = \frac{1 - \frac{1}{2} \theta_{y6}^2}{\theta_{y6}^2} \text{ for small angles}$$

$$\theta_{y6} = \sqrt{\theta_{x6}^2 + \theta_{z6}^2}$$

$$\text{and: } \theta_{z6} = (\Delta V_{x6} - \Delta V_x \text{ Bias}) (S.F._x) / (\Delta T) \text{ (local g)}$$

$$\theta_{x6} = (\Delta V_{z6} - \Delta V_z \text{ Bias}) (S.F._z) / (\Delta T) \text{ (local g)}$$

$$\text{and: } V_x \text{ Bias} = (X \text{ PIPA Bias}) (\Delta T) / S.F._x$$

$$V_z \text{ Bias} = (Z \text{ PIPA Bias}) (\Delta T) / S.F._z$$

S.F. and Bias terms are obtained from positions 1 through 4 of the IMU Performance Test.

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6.2.16.10.2 Obtain data from last historical IRIG and PIPA test and complete Table X₁₋₁.

Table X₁₋₁

| Parameter | Units | Recorded Value |
|-------------------|---------------------|----------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRZ | meru/g | |
| ADLAX | meru/g | |
| ADLAY | meru/g | |
| ADLAZ | meru/g | |
| X PIPA S.F. Error | PPM | |
| Y PIPA S.F. Error | PPM | |
| Z PIPA S.F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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6.2.16.10.3 Obtain data from the second last historical IRIG and PIPA test and complete Table X_{1-2} .

TABLE X_{1-2}

| Parameter | Units | Recorded Value |
|-------------------|---------------------|----------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRZ | meru/g | |
| ADIX | meru/g | |
| ADIY | meru/g | |
| ADIZ | meru/g | |
| X PIPA S.F. Error | FPM | |
| Y PIPA S.F. Error | PPM | |
| Z PIPA S.F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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6.2.16.10.4 Obtain data from the third last historical IRIG and PIPA test and complete Table X_{1-3} .

TABLE X_{1-3}

| Parameter | Units | Recorded Value |
|-------------------|---------------------|----------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRZ | meru/g | |
| ADIAX | meru/g | |
| ADIAY | meru/g | |
| ADIAZ | meru/g | |
| X PIPA S.F. Error | PPM | |
| Y PIPA S.F. Error | PPM | |
| Z PIPA S.F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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6.2.16.10.5 Compute the PIPA Scale Factor error in parts per million from the values recorded in 6.2.16.10.1 and record in Table X₁.

- a. PIPA S.F. Error = $\left[\frac{2 \text{ local } g}{+PIPAG - (PIPAG)} - 1.000000 \right] 10^6$
- b. X PIPA S.F. Error = $\left[\frac{2 \text{ local } g}{\text{line 2} - \text{line 4}} - 1.000000 \right] 10^6$
- c. Y PIPA S.F. Error = $\left[\frac{2 \text{ local } y}{G'_5 - G'_6} - 1.000000 \right] 10^6$
- d. Z PIPA S.F. Error = $\left[\frac{2 \text{ local } g}{\text{line 7} - \text{line 9}} - 1.000000 \right] 10^6$

The PIPA S.F. Error shall not exceed ± 2000 PPM

| TABLE XXII Local Gravity values | |
|---------------------------------|--------------------------------------|
| Location | Local Gravity (cm/sec ²) |
| NAA | 979.56 |
| MSC | 979.29 |
| KSC | 979.24 |

6.2.16.10.6 Compute the PIPA Bias in cm/sec² from the values recorded in 6.2.16.10.1 and record in Table X₁.

- a. PIPA Bias = $\frac{+PIPAG + (-PIPAG)}{2}$
- b. X PIPA Bias = $\frac{\text{line 2} + \text{line 4}}{2}$
- c. Y PIPA Bias = $\frac{G'_5 + G'_6}{2}$
- d. Z PIPA Bias = $\frac{\text{line 7} - \text{line 9}}{2}$

The PIPA Bias shall not exceed ± 2.28 cm/sec².

6.2.16.10.7 Calculate NBD, ADSRA, and ADIA from the values recorded in 6.2.16.10.1 and record in Table X₁.

- a. NBDX = - (line 6) =
NBDX = - (line 1) =
NBDZ = line 3 =
NBD shall not exceed ± 15 meru.

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6.2.16.10.7 (continued)

b. $ADSRAX = \frac{(\text{line 13} - \text{line 6})}{.707} =$

$ADSRAY = \text{line 8} - \text{line 1}$

$ADSRAZ = \frac{\text{line 15} + \text{line 3}}{.707}$

ADGRA shall not exceed ± 40 meru/g.

c. $ADIAAX = \text{line 5} - \text{line 6}$

$ADIAAY = \frac{\text{line 16} - .707 (NBDY - NBDX) - .5 (ADSRAX - ADIAAX)}{.5}$

$ADIAZ = \text{line 10} - \text{line 3}$

ADIA shall not exceed ± 100 meru/g

6.2.16.10.8 Perform the following calculations for each term in Table X_1 , and record the results in Table D.

$D_1 = |X_{1-1} - X_1|$

$D_2 = |X_{1-1} - X_1| + |X_{1-2} - X_{1-1}|$

$D_3 = |X_{1-3} - X_{1-2}| + |X_{1-2} - X_{1-1}| + |X_{1-1} - X_1|$

X_1 = Data point just obtained

X_{1-1} = last historical data point

X_{1-2} = second last historical data point

X_{1-3} = third last historical data point

NOTE: D_1 calculations begin with the first data point after ISS Pre-Vib; D_2 calculations begin with the second data point after ISS Pre-Vib; D_3 calculations begin with the third data point after Pre-Vib.

| | | | | | | | |
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TABLE X₁

| Parameter | Units | Calculated Value |
|-------------------|---------------------|------------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADGRAX | meru/g | |
| ADGRAY | meru/g | |
| ADGRAZ | meru/g | |
| ADLAX | meru/g | |
| ADLAY | meru/g | |
| ADLAZ | meru/g | |
| X PIPA S.F. Error | PPM | |
| Y PIPA S.F. Error | PPM | |
| Z PIPA S.F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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TABLE D

| PARAMETER | UNITS | D ₁ | MAX. | D ₂ | MAX. | D ₃ | MAX. |
|-------------------|---------------------|----------------|------|----------------|------|----------------|------|
| NBDX | meru | | 6 | | 9 | | 11 |
| NBDY | meru | | 6 | | 9 | | 11 |
| NBDZ | meru | | 6 | | 9 | | 11 |
| ADSRAX | meru/g | | 14 | | 21 | | 25 |
| ADSRAY | meru/g | | 14 | | 21 | | 25 |
| ADSRZ | meru/g | | 14 | | 21 | | 25 |
| ADLAX | meru/g | | 17 | | 33 | | 40 |
| ADLAY | meru/g | | 17 | | 33 | | 40 |
| ADLAZ | meru/g | | 17 | | 33 | | 40 |
| X PIPA S.F. Error | PPM | | 400 | | 500 | | 600 |
| Y PIPA S.F. Error | PPM | | 400 | | 500 | | 600 |
| Z PIPA S.F. Error | PPM | | 400 | | 500 | | 600 |
| X PIPA Bias | cm/sec ² | | 0.5 | | 0.7 | | 0.9 |
| Y PIPA Bias | cm/sec ² | | 0.5 | | 0.7 | | 0.9 |
| Z PIPA Bias | cm/sec ² | | 0.5 | | 0.7 | | 0.9 |

6.2.16.10.9 Failure to meet the above criteria shall result in retest according to 5.4.2.

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6.2.17 SXT-NB-Fine Alignment Test

6.2.17.1 Deleted: Master Indication of ... before power on.

6.2.17.2 The G&N shall have had OPERATE power applied for a minimum of 1 hour.

6.2.17.3 Set the G/N POWER-OPTICS switch to OPTICS. Verify that +28 VDC OPTICS OPERATE BUS (CG 1530) is $+28.0 \pm 3.0$ VDC. Verify that the OPTX 28V 800 cps 1% 0° ph (CG 1211) and OPTX 28V 800 cps 5% -90° ph (CG 1212) are not flashing on the CRT.

6.2.17.4 Enter VERB 01 NOUN 10 into K-148. Press the ENTER pushbutton. Enter 00003 into K-148. Press the ENTER pushbutton. Record R1 = AAAAA.

If the recorded value is within any of the sets of limits given in Table I proceed with the test. If the recorded value is NOT within any of the sets of limits wait 30 minutes and then repeat this step.

TABLE 1

| MIN VALUE | | MAX VALUE |
|-----------|-------|-----------|
| 00000 | AAAAA | 03242 |
| 04000 | AAAAA | 07242 |
| 10000 | AAAAA | 13242 |
| 14000 | AAAAA | 17242 |
| 20000 | AAAAA | 23242 |
| 24000 | AAAAA | 27242 |
| 30000 | AAAAA | 33242 |
| 34000 | AAAAA | 37242 |

6.2.17.5 On the G&N Indicator Control Panel set the following switches to the position indicated.

- a. OPTICS TEL TRUN to SLAVE to SXT
- b. OPTICS COUPLING to DIRECT
- c. OPTICS SPEED to LO
- d. OPTICS MODE to MAN
- e. OPTICS ZERO to ZERO

6.2.17.6 Deleted: ... showing ...

- a. VERB 01 NOUN 10, ENTER
- b. 00003, ENTER

Record R1 = AAAAA

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- VIRAL, POLYMER, 1971-1972
- 1972, p. 107
- BRUNNEN, and J. H. HARRIS: *Journal of Polymer Science* 1973, 10, 1000-1001.

TABLE II

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|

a. VERB 92, ENTER
b. 00003, ENTER

a. $R1 = +13500$
b. $R2 = +xx, xxx$ (Site Latitude from Table I)

TABLE I

| <u>SITE</u> | <u>LATITUDE</u> |
|-------------|-----------------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC M90 | +28.523 |
| KSC VAB | +28.585 |
| KSC PAD 39 | +28.607 |

- a. VERB 21, ENTER
- b. +13500, ENTER
- c. VERB 22, ENTER
- d. +xx, xxx, ENTER (+xx, xxx = Site Latitude from Table I)
- e. VERB 33, ENTER

- a. +00001, ENTER (Position Number)
- b. +00000, ENTER
- c. +00001, ENTER

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| 6.2.17.12 | Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3. | | | | | |
| | a. R1 = +xxx.xx (Y _{NB} Azimuth) | | | | | |
| | b. R2 = ±xx.xxx (Y _{NB} Elevation) | | | | | |
| | c. R3 = 00001 | | | | | |
| 6.2.17.13 | If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct Y _{NB} azimuth and elevation, correct the data by entering the following sequence into the DSKY. | | | | | |
| | a. VERB 24, ENTER | | | | | |
| | b. +xxx.xx±002.00 degrees, ENTER (Y _{NB} Azimuth) | | | | | |
| | c. ±xx.xxx±02.000 degrees, ENTER (Y _{NB} Elevation) | | | | | |
| | d. VERB 33, ENTER | | | | | |
| 6.2.17.14 | Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3. | | | | | |
| | a. R1 = +xxx.xx (Z _{NB} Azimuth) | | | | | |
| | b. R2 = ±xx.xxx (Z _{NB} Elevation) | | | | | |
| | c. R3 = 00002 | | | | | |
| 6.2.17.15 | If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct Z _{NB} azimuth and elevation, correct the data by entering the following sequence into the DSKY. | | | | | |
| | a. VERB 24, ENTER | | | | | |
| | b. +xxx.xx±002.00 degrees, ENTER (Z _{NB} Azimuth) | | | | | |
| | c. ±xx.xxx±02.000 degrees, ENTER (Z _{NB} Elevation) | | | | | |
| | d. VERB 33, ENTER | | | | | |
| 6.2.17.16 | Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3. | | | | | |
| | a. R1 = +xxx.xx (Target 1 Azimuth) | | | | | |
| | b. R2 = ±xx.xxx (Target 1 Elevation) | | | | | |
| | c. R3 = 00001 | | | | | |
| 6.2.17.17 | If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct azimuth and elevation for Target 1, correct the data by entering the following sequence into the DSKY. | | | | | |
| | a. VERB 24, ENTER | | | | | |
| | b. +xxx.xx±000.10 degrees, ENTER (Target 1 Azimuth) | | | | | |
| | c. ±xx.xxx±00.010 degrees, ENTER (Target 1 Elevation) | | | | | |
| | d. VERB 33, ENTER | | | | | |

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| 6.2.17.18 | Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3. a. R1 = +xxx.xx (Target 2 Azimuth) b. R2 = ±xx.xxx (Target 2 Elevation) c. R3 = 00002 | | | | | | |
| 6.2.17.19 | If the data displayed is correct proceed to 6.2.17.22. If R1 and R2 do not contain the correct azimuth and elevation for Target 2, correct the data by entering the following sequence into the DSKY. a. VERB 24, ENTER b. +xxx.xx±00.10 degrees, ENTER (Target 2 Azimuth) c. ±xx.xxx±00.010 degrees, ENTER (Target 2 Elevation) | | | | | | |
| 6.2.17.20 | Set the OPTICS ZERO switch to OFF. Enter VERB 33, ENTER into the DSKY. | | | | | | |
| 6.2.17.21 | When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00001, on the DSKY set the OPTICS MODE switch on the G&N Indicator Control Panel to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL. | | | | | | |
| 6.2.17.22 | Using the Optics Hand Controller, align the SXT SLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton. | | | | | | |
| 6.2.17.23 | When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement of the TPAC, set the OPTICS MODE switch to MANUAL. | | | | | | |
| 6.2.17.24 | Using the Optics Hand Controller, align the SXT SLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton. NOTE: The following two MARKS must be performed as quickly as possible. In no case shall the time between the first and second MARK exceed two minutes. | | | | | | |
| 6.2.17.25 | After 90 seconds observe the DSKY for VERB 51 and NOUN 70 flashing and R1 = 00001. Set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL. | | | | | | |

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- 6.2.17.26 Using the Optics Hand Controller, align the SXT SLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.27 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement of the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.28 Using the Optics Hand Controller, align the SXT SLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.29 In approximately 7 minutes VERB 06 NOUN 98 shall flash on the DSKY and the test results shall be displayed. R1 and R2 on the DSKY shall display the misalignment of one of the horizontal PIPA's in arc seconds (R1 = whole, R2 = fractional). Record R1 and R2. (See Table III for PIPA displayed).
- 6.2.17.30 Enter VERB 33 ENTER into the DSKY. When VERB 06 NOUN 98 flashes R1 and R2 on the DSKY shall display the misalignment of the second horizontal PIPA in arc seconds (R1 whole, R2 fractional). (See Table III for PIPA displayed). Record R1 and R2.
- 6.2.17.31 Enter VERB 34 ENTER into the DSKY to terminate the test. Wait 5 seconds.
- 6.2.17.32 Repeat steps 6.2.17.4 and 6.2.17.8 through 6.2.17.31 substituting No. 00002 in 6.2.17.11.a.
- 6.2.17.33 Enter the following sequence into the DSKY:
- VERB 36, ENTER
 - VERB 41 NOUN 20, ENTER
 - +00000, ENTER
 - +00000, ENTER
 - +00000, ENTER

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6.2.17.34 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.

Table III. DISPLAY CONDITIONS AT TEST COMPLETION

| Position | SM Orientation | | | Horizontal Misalignment Component | |
|----------|-----------------|-----------------|-----------------|-----------------------------------|-----------------|
| | X _{SM} | Y _{SM} | Z _{SM} | 6.2.17.29 | 6.2.17.30 |
| 1. | UP | SW | SE | Y _{SM} | Z _{SM} |
| 2. | SE | SW | DN | X _{SM} | Y _{SM} |
| 3.* | SE | UP | SW | X _{SM} | Z _{SM} |

*Position 3 is not run in the Spacecraft because of GIMBAL LOCK considerations.

6.2.17.35 Calculations

- 6.2.17.35.1 a. Y_{SM} misalignment = () R₁.R₂
b. Z_{SM} misalignment = () R₁.R₂
c. X_{SM} misalignment = () R₁.R₂
d. Y_{SM} misalignment = () R₁.R₂

6.2.17.35.2 Enter the latest values from 6.2.16 IMU Performance Test.

- a. X PIPA bias = _____ cm/sec²
b. Y PIPA bias = _____ cm/sec²
c. Z PIPA bias = _____ cm/sec²
d. $\theta_x = 210$ (X PIPA bias) = _____ arc sec.
e. $\theta_y = 210$ (Y PIPA bias) = _____ arc sec.
f. $\theta_z = 210$ (Z PIPA bias) = _____ arc sec.

- 6.2.17.35.3 a. Y_{SM} misalignment (Bias corrected) = 6.2.17.35.1a - θ_y = _____ arc sec.
b. Z_{SM} misalignment (Bias corrected) = 6.2.17.35.1b - θ_z = _____ arc sec.
c. X_{SM} misalignment (Bias corrected) = 6.2.16.35.1c - θ_x = _____ arc sec.
d. Y_{SM} misalignment (Bias corrected) = 6.2.17.35.1d - θ_y = _____ arc sec.

The SM misalignment in each orientation, excluding PIPA bias, shall not exceed ± 150 arc seconds.

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| 6.2.18 | Gyrocompassing Test | |
| 6.2.18.1 | Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify that +28 vdc OPTICS OPERATE BUS (CG 1530) is +28.0±3.0 vdc. Verify that the OPTX 28V 800 cps 1% 0° (CG 1211) and OPTX 28V 800 cps 5% -90° (CG 1212) are not flashing in the CRT. | |
| 6.2.18.2 | Load the Inertial Instrument Calibration Data into the CMC using the following sequence: | |
| | VERB 21 | NOUN 01 |
| | 01716 | ENTR |
| | XXXXX (X PIPA BIAS) | ENTR |
| | 01717 | ENTR |
| | XXXXX (X PIPA S. F.) | ENTR |
| | 01720 | ENTR |
| | XXXXX (Y PIPA BIAS) | ENTR |
| | 01721 | ENTR |
| | XXXXX (Y PIPA S. F.) | ENTR |
| | 01722 | ENTR |
| | XXXXX (Z PIPA BIAS) | ENTR |
| | 01723 | ENTR |
| | XXXXX (Z PIPA S. F.) | ENTR |
| | 01724 | ENTR |
| | XXXXX (NBDX) | ENTR |
| | 01725 | ENTR |
| | XXXXX (NBDY) | ENTR |
| | 01726 | ENTR |
| | XXXXX (NBDZ) | ENTR |
| | 01727 | ENTR |
| | XXXXX (ADIA X) | ENTR |
| | 01730 | ENTR |
| | XXXXX (ADIA Y) | ENTR |
| | 01731 | ENTR |
| | XXXXX (ADIA Z) | ENTR |
| | 01732 | ENTR |
| | XXXXX (ADSRAX) | ENTR |

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6.2.18.2
(Continued)

| | |
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| 01733 | ENTR |
| XXXXX (ADSRAY) | ENTR |
| 01734 | ENTR |
| XXXXX (ADSRAY) | ENTR |

6.2.18.3 Enter NB Azimuth and Site Latitude (from Table III) and Launch Azimuth into the CMC using the following sequence:

| | | |
|---------|---------|-----------------------------------|
| VERB 21 | NOUN 01 | ENTR |
| 2506 | | ENTR (NB Azimuth) |
| XXXXX | | ENTR (fraction of a Rev Hi order) |
| 2507 | | ENTR |
| XXXXX | | ENTR (NB Azimuth) |
| | | ENTR (fraction of a Rev Lo order) |
| 2510 | | ENTR |
| XXXXX | | ENTR (Site Latitude) |
| | | ENTR (fraction of a Rev Hi order) |
| 2511 | | ENTR |
| XXXXX | | ENTR (Site Latitude) |
| | | ENTR (fraction of a Rev Lo order) |
| 2755 | | ENTR |
| XXXXX | | ENTR (Launch Azimuth) |
| | | ENTR (fraction of a Rev Hi order) |
| 2756 | | ENTR |
| XXXXX | | ENTR (Launch Azimuth) |
| | | ENTR (fraction of a Rev Lo order) |

TABLE III

| Location | Latitude (Fraction of a Rev) Hi Order | Low Order |
|------------|--|-----------|
| NAA | 03007 | 36671 |
| MSC | 02423 | 23341 |
| KSC M80 | 02422 | 04033 |
| KSC VAB | 02424 | 36151 |
| KSC PAD 39 | 02425 | 37327 |

6.2.18.4 Enter the following into the CMC:

VERB 37 ENTER, 01 ENTER

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| 6.2.18.5 | | |
| To change the launch azimuth perform the following: | | |
| a. VERB 78, ENTER | | |
| b. R1 displays present launch azimuth | | |
| c. To change launch azimuth enter | | |
| VERB 21, ENTER | | |
| ±XXX.XX ENTER (New launch azimuth) | | |
| NOTE: Using the beginning of Prog. 02 as t_0 , initial start time, read/record CDUX, CDUY, and CDUZ every 15 minutes for 120 min and every 5 minutes for the next 60 minutes. | | |
| 6.2.18.6 | | |
| Enter VERB 33, ENTER into the DSKY. On the DSKY observe the PROGRAM display change to 05 after approximately 90 seconds. Approximately 5 minutes later observe the PROGRAM display change to 02. When PROG display changes to 02 record time as T_0 . | | |
| 6.2.18.7 | | |
| Gyro Compassing Stability | | |
| 6.2.18.7.1 | | |
| 120 minutes after T_0 record the Outer, Inner and Middle CDU Gimbal angles from the CRT. | | |
| 6.2.18.7.2 | | |
| Repeat above step every 5 minutes for the next 120 minutes. | | |
| 6.2.18.7.3 | | |
| The peak to peak spread of the outer gimbal angle shall not exceed 0.12° . | | |
| 6.2.18.7.4 | | |
| The peak to peak spread of the Inner and Middle gimbal angles shall not exceed 0.06° . | | |
| 6.2.18.8 | | |
| Gyro Compassing Accuracy | | |
| 6.2.18.8.1 | | |
| After 240 minutes from T_0 set the OPTICS ZERO switch on the G&N Indicator to ZERO. | | |
| 6.2.18.8.2 | | |
| Enter the following into the DSKY: | | |
| VERB 21 | NOUN 03 | ENTER |
| 02553 | | ENTER |
| +XXX.XX | ±000.01 | ENTER (Target No. 1 AZ) |
| | | ENTER |
| 02554 | | ENTER |
| +00.000 | | ENTER (Target No. 1 EL) |
| | | ENTER |
| 02555 | | ENTER |
| | ±000.01 | ENTER (Target No. 2 AZ) |
| | | ENTER |
| 02556 | | ENTER |
| +00.000 | | ENTER (Target No. 2 EL) |

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- 6.2.18.8.2
(Continued) On the G&N Indicator Control Panel, set the Optics ZERO switch to OFF and the controller speed to HI. Drive the StLOS to the approximate position to Target No. 1. Set the Controller Speed switch to LO.
- NOTE: Read the following 10 steps before proceeding. These are time critical steps and must be performed as rapidly as possible.
- 6.2.18.8.3 Enter VERB 65, ENTER into DSKY.
Observe the PROGRAM display on the DSKY change to 03.
- 6.2.18.8.4 When VERB 06 NOUN 41 flashed on the DSKY, insure that R1 and R2 display Target 1 azimuth and elevation.
- a. R1 = +XXX.XX (Target 1 azimuth)
b. R2 = +XX.XXX (Target 1 elevation)
- 6.2.18.8.5 Verify the data appearing in R1 and R2 and if correct, proceed. If not correct, perform the following sequence:
- a. VERB 24, ENTER
b. +XXX.XX, ENTER (Target 1 azimuth)
c. ±XX.XXX, ENTER (Target 1 elevation)
- 6.2.18.8.6 After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY.
- 6.2.18.8.7 When VERB 06 NOUN 41 flashes on the DSKY, insure that R1 and R2 display Target 2 azimuth and elevation.
- a. R1 = XXX.XX (Target 2 azimuth)
b. R2 = XX.XXX (Target 2 elevation)
- 6.2.18.8.8 Verify the data appearing in R1 and R2 and if correct, perform the following sequence:
- a. VERB 24, ENTER
b. +XXX.XX, ENTER (Target 2 azimuth)
c. ±XX.XXX, ENTER (Target 2 elevation)
- 6.2.18.8.9 After the correct readings for R1 and R2 are verified enter VERB 33, ENTER into the DSKY.
- 6.2.18.8.10 Using the Optics Hand Controller, align the SXT StLOS to Target 1 and press MARK pushbutton. If not satisfied with MARK, press the MARK REJECT pushbutton and repeat this step.

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- 6.2.18.8.11 Set the OPTICS SPEED switch to HI. Using the Optics Hand Controller, drive the SXT SLOS to the approximate position of Target 2.
- 6.2.18.8.12 Set the OPTICS SPEED switch to LO. Using the Optics Hand Controller, align the SXT SLOS to Target 2 and press the MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied, press the MARK REJECT pushbutton and repeat this step.
- 6.2.18.8.13 On the DSKY observe the following data displayed:
- VERB 06 NOUN 93
 - R1 = ±XX.XXX (X gyro elevation error, deg. 4 hr.)
 - R2 = ±XX.XXX (Y gyro elevation error, deg. 4 hr.)
 - R3 = ±XX.XXX (Z gyro azimuth error, deg. 4 hr.)
- Record R1, R2 and R3. The X and Y gyro elevation error shall be 0.00 ± 0.045 degrees and the Z gyro azimuth error shall be 0.00 ± 0.573 degrees.
- 6.2.18.8.14 Enter VERB 34, ENTER into the DSKY. Observe the PROGRAM display change to 02. Set the Optics ZERO Switch on the G&N Indicator Control Panel to ZERO.
- 6.2.18.8.15 Enter VERB 36 into the DSKY. Press the enter pushbutton.
- 6.2.18.8.16 Enter VERB 41 NOUN 20 into the DSKY. Press the ENTER pushbutton. Enter +00000 into the DSKY three times. Press the ENTER pushbutton after each entry. Set the G&N Power Optics switch on the LEB Lighting Control Panel to OFF.
- 6.2.19 CMC Voltage Margin Test
- 6.2.19.1 Verify that the G&N IMU HTR MNA & MNB circuit breakers are engaged, Computer NMA & NMB breakers are engaged, IMU MNA & MNB circuit breakers are not engaged, and the G&N Power - IMU switch on the LEB Lighting Control Panel is in the OFF position.
- 6.2.19.2 On the PSA Adapter Module set the INHIBIT VOLTAGE FAIL switch to ON.
- Caution: During the performance of this test the +4 VDC CMC Power Supply shall not be operated at less than +2.5 VDC or greater than 5.2 VDC (CG 1030). The +14 VDC CMC Power Supply shall not be operated at less than +8.5 VDC or greater than +17.0 VDC (CG 1020). Rotate the LEB LTS NUMERICS SEL. to approximately center position. Decrease to absolute minimum discernable lighting.
- Note: The flashing indication of the CMC Power Supplies on CRT may be disregarded for this test. The charts in Table I may be used to determine approximate values for the "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.

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- 6.2.19.3 Into R154 insert 0001. Verify and execute.
- 6.2.19.4 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.5 Into C156 insert -050001234. Verify and execute. Verify on the CRT that GV0106 is between -4.0 and -6.0 VDC.
- 6.2.19.6 Into R154 insert 0111. Verify and execute.
- 6.2.19.7 Observe CG 1020, +14 VDC CMC Power Supply and CG 1030, +4 VDC CMC Power Supply, on the CRT. Repeat 6.2.19.3 through 6.2.19.6 adjusting each C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC and CG 1030 is +3.40 (+0.03 - 0.00) VDC.
- 6.2.19.8 Initiate CMC Self Check by inserting the following into K148:
- a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- Wait 200 seconds
- 6.2.19.9 Insure that the DSKY RESTART lamp and Program Alarm lamp does not light.
- 6.2.19.9.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.10 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify the RESTART lamp on the DSKY is lighted. Disregard other DSKY indications. If RESTART does not light, repeat 6.2.19.3. Verify CMC Warning masters alarm are lighted.
- 6.2.19.11 Set the INHIBIT VOLTAGE FAIL switch to ON. Insert the following into K148:
- a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- 6.2.19.12 Into R154 insert 0001. Verify and execute.
- 6.2.19.13 Into C156 insert +108001244. Verify and execute. Verify on the CRT that GV0116 is between +0.8 and +11.8 VDC.
- 6.2.19.14 Into R154 insert 0111. Verify and execute.
- 6.2.19.15 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.12 through 6.2.19.14 adjusting the C-Start entry until CG 1020 is 16.4 (+0.0, -0.1) VDC.

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- 6.2.19.16 Press ERROR RESET on KI48. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.16.1 Into R154 insert 0011. Verify and execute.
- 6.2.19.17 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted.
- 6.2.19.18 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to ON. Into KI48 insert:
- ERROR RESET
 - VERB 21 NOUN 27, ENTER
 - 77777, ENTER
- 6.2.19.19 Into R154 insert 0001. Verify and execute.
- 6.2.19.20 Into C156 enter +092001234. Verify and execute. Verify on the CRT that GV0106 is between +8.2 and +10.2 VDC.
- 6.2.19.21 Into R156 insert 0111. Verify and execute.
- 6.2.19.22 Observe CG 1030, +4 VDC CMC Power Supply on the CRT. Repeat 6.2.19.19 through 6.2.19.21 adjusting the C-Start entry until CG 1030 is +4.60 (+0.00, -0.03) VDC.
- 6.2.19.23 Press ERROR RESET on KI48. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.23.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.24 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Verify CMC Warning master alarms are lighted.
- 6.2.19.25 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to ON. Into KI48 insert:
- ERROR RESET
 - VERB 21 NOUN 27, ENTER
 - 77777, ENTER
- 6.2.19.26 Into R154 insert 0001. Verify and execute.
- 6.2.19.27 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.28 Into R154 insert 0111. Verify and execute.

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- 6.2.19.29 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.26 through 6.2.19.28 adjusting the C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC.
- 6.2.19.30 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.30.1 Into R154 insert 0011. Verify and execute.
- 6.2.19.31 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted.
- 6.2.19.32 Into R154 insert 0000. Verify and execute.
- 6.2.19.33 Terminate CMC Self-Check by inserting into K148.
 - a. ERROR RESET
 - b. VERB 21, NOUN 27, ENTER
 - c. 00000, ENTER
- 6.2.19.34 Ensure that CG 1020, +14 VDC CMC Power Supply indication, is +14.0±0.4 and that CG 1030, +4 VDC CMC Power Supply indication is +4.00±0.20 VDC on the CRT.

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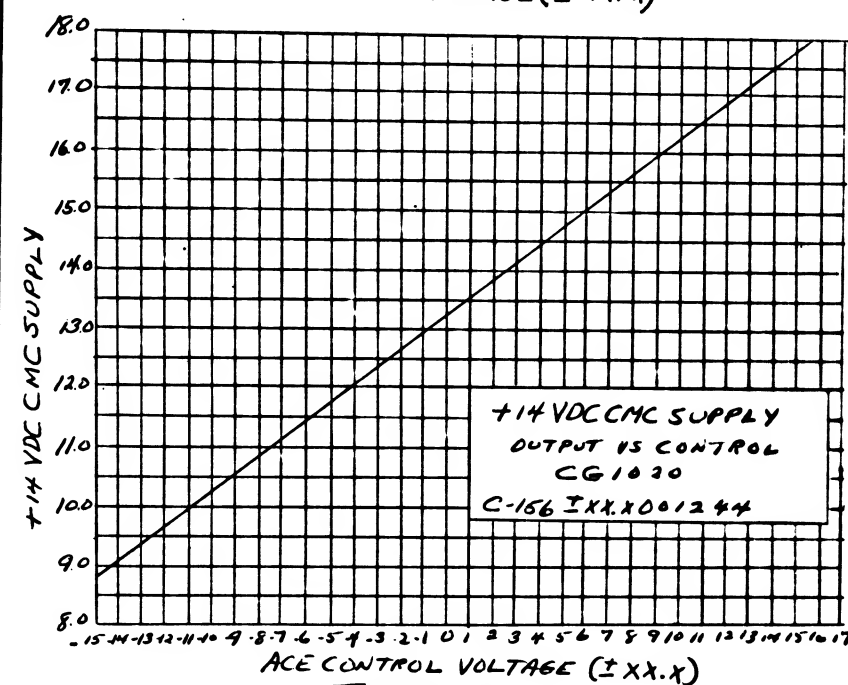
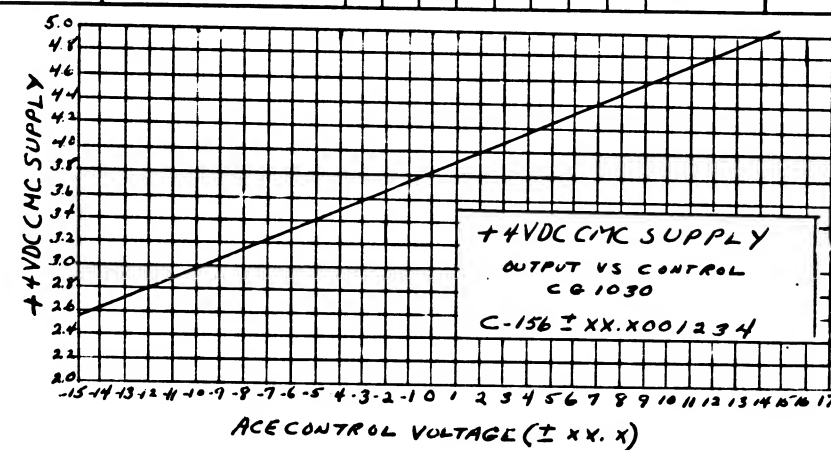


TABLE I

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- 6.2.20 Spacecraft Control and Displays Test.
- 6.2.20.1 Proceed with this test if the Operate Power On Test of 6.2.3 and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2 before proceeding.
- 6.2.20.2 FDAI Attitude Error.
- 6.2.20.2.1 Insert in K148
- a. V92 ENTER
- b. 00013 ENTER
- 6.2.20.2.2 Observe on the CRT PROG 07. In approximately 5 sec observe NO ATT ON. In approximately 20 sec observe V06 NO1 flashing and R1, R2 and R3 approximately 00000.
- 6.2.20.2.3 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.4 Observe on CRT
- a. V06 N 01 Flashing
- b. R1 +00385
- c. R2 -00385
- d. R3 +00385
- e. NO ATT OFF
- 6.2.20.2.5 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +5.06±0.50V rms
- b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -5.06±0.50V rms
- c. CG 2249 YAW ATT ERROR - CDU DAC OUT +5.06±0.50V rms
- 6.2.20.2.6 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.7 Observe on CRT
- a. V06 NO1 Flashing
- b. R1 +00384
- c. R2 -00384
- d. R3 +00384

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- 6.2.20.2.8 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $+5.06 \pm 0.50V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $-5.06 \pm 0.50V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $+5.06 \pm 0.50V$ rms
- 6.2.20.2.9 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.10 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 +00160
 - c. R2 -00160
 - d. R3 +00160
- 6.2.20.2.11 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $+2.11 \pm 0.21V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $-2.11 \pm 0.21V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $+2.11 \pm 0.21V$ rms
- 6.2.20.2.12 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.13 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 +00135
 - c. R2 -00135
 - d. R3 +00135
- 6.2.20.2.14 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $+1.78 \pm 0.18V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $-1.78 \pm 0.18V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $+1.78 \pm 0.18V$ rms
- 6.2.20.2.15 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.16 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 +00090
 - c. R2 -00090
 - d. R3 +00090

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- 6.2.20.2.17 Record CRT indications.
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $+1.19 \pm 0.12V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $-1.19 \pm 0.12V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $+1.19 \pm 0.12V$ rms
- 6.2.20.2.18 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.19 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 +00000
 - c. R2 +00000
 - d. R3 -00090
- 6.2.20.2.20 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $0.00 \pm 0.06V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $0.00 \pm 0.06V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $-1.19 \pm 0.12V$ rms
- 6.2.20.2.21 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.22 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 -00090
 - c. R2 +00090
 - d. R3 -00135
- 6.2.20.2.23 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $-1.19 \pm 0.12V$ rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+1.19 \pm 0.12V$ rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $-1.19 \pm 0.12V$ rms
- 6.2.20.2.24 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.25 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 -00135
 - c. R2 +00135
 - d. R3 -00160

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- 6.2.20.2.26 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -1.78±0.18V rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +1.78±0.18V rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT -2.11±0.21V rms
- 6.2.20.2.27 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.28 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 -00160
 - c. R2 +00160
 - d. R3 -00384
- 6.2.20.2.29 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -2.11±0.21V rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +2.11±0.21V rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT -5.06±0.50V rms
- 6.2.20.2.30 Insert K148
- a. VERB 33, ENTER
- 6.2.20.2.31 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 -00384
 - c. R2 +00384
 - d. R3 -00385
- 6.2.20.2.32 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -5.06±0.50V rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +5.06±0.50V rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT -5.06±0.50V rms
- 6.2.20.2.33 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.34 Observe on CRT
- a. VO6 NO1 Flashing
 - b. R1 -00385
 - c. R2 +00385
 - d. R3 +00000

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- 6.2.20.2.35 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $-5.06 \pm 0.50V$ rms peak
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+5.06 \pm 0.50V$ rms peak
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT $0.00 \pm 0.06V$ rms peak
- 6.2.20.2.36 Insert in K148
- a. VERB 21 NOUN 01 ENTER
 - b. 02545 ENTER
 - c. 03362 ENTER
 - d. VERB 33 ENTER
- 6.2.20.2.37 Observe on CRT
- a. VO6 NO2 Flashing
 - b. NO ATT ON
 - c. R1 +00000 approximately
 - d. R2 +00000 approximately
 - e. R3 +00000 approximately

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- 6.2.20.3 TVC Test
- 6.2.20.3.1 The G/N Autopilot Control and SPS Ready discretes shall be applied to the G/N Interface.
- 6.2.20.3.2 Set the OPTICS MODE selector on the Indicator Control Panel to MAN. Set the OPTICS ZERO switch to OFF.
- 6.2.20.3.3 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.3.4 Observe on CRT
- a. V 01 N10 Flashing
- b. R1 X7373
- c. R3 00030
- 6.2.20.3.5 Insert in K148
- a. V 33 ENTER
- 6.2.20.3.6 Observe on CRT
- a. V 01 Noun 10 Flashing
- b. R1 37777
- c. R3 00031
- 6.2.20.3.7 Insert in K148
- a. V 33 ENTER
- 6.2.20.3.8 Observe on CRT
- a. V06 NC2 Flashing
- b. R1 +00385
- c. R2 -00385
- d. R3 +00003
- 6.2.20.3.9 Record CRT indications
- a. CG 3722 TRUNNION CDI DAC OUTPUT +10.12±1.00V rms
- b. CG 3721 SHAFT CDI DAC OUTPUT -10.12±1.00V rms
- 6.2.20.3.10 Insert in K148
- a. VERB 33, ENTER

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- 6.2.20.3.11 Observe on CRT
- a. VO6 N O2 Flashing
 - b. R1 +00384
 - c. R2 -00384
 - d. R3 +00003
 - e. NO ATT OFF
- 6.2.20.3.12 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +10.12±1.00V rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT -10.12±1.00V rms
- 6.2.20.3.13 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.3.14 Observe on CRT
- a. VO6 N O2 Flashing
 - b. R1 +00160
 - c. R2 -00160
 - d. R3 +00003
- 6.2.20.3.15 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +4.22±0.42V rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT -4.22±0.42V rms
- 6.2.20.3.16 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.17 Observe on CRT
- a. VO6 N O2 Flashing
 - b. R1 +00135
 - c. R2 -00135
 - d. R3 +00003
- 6.2.20.3.18 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +3.56±0.36V rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT -3.56±0.36V rms
- 6.2.20.3.19 Insert in K148
- a. VERB 33 ENTER

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- 6.2.20.3.20 Observe on CRT
- a. VO6 N 02 Flashing
 - b. R1 +00090
 - c. R2 -00090
 - d. R3 +00003
- 6.2.20.3.21 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT $+2.38 \pm 0.24V$ rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT $-2.38 \pm 0.24V$ rms
- 6.2.20.3.22 Set the OPTICS SPEED switch on the Indicator Control panel to HI.
- 6.2.20.2.23 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.24 Observe on CRT
- a. VO6 N 02 Flashing
 - b. R1 +00000
 - c. R2 +00000
 - d. R3 +00003
- 6.2.20.3.25 While holding the Optics Hand Controller up and left (45°) no longer than 10 seconds, record CRT indications.
- a. CG 3722 TRUNNION CDU DAC OUTPUT $0.00 \pm 0.12V$ rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT $0.00 \pm 0.12V$ rms
- 6.2.20.3.26 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.27 Observe on CRT
- a. VO6 N 02 Flashing
 - b. R1 -00090
 - d. R2 +00090
 - d. R3 +00003
- 6.2.20.3.28 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT $-2.38 \pm 0.24V$ rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT $+2.38 \pm 0.24V$ rms

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| 6.2.20.3.29 | Set the OPTICS ZERO switch and the Indicator Control panel to ZERO for 30 seconds then return to OFF. | | | | | | | | | | |
| 6.2.20.3.30 | Insert in K148 | | | | | | | | | | |
| | a. | VERB 33 | ENTER | | | | | | | | |
| 6.2.20.3.31 | Observe on CRT | | | | | | | | | | |
| | a. | VO6 | N 02 | Flashing | | | | | | | |
| | b. | R1 | -00135 | | | | | | | | |
| | c. | R2 | +00135 | | | | | | | | |
| | d. | R3 | +00003 | | | | | | | | |
| 6.2.20.3.32 | Record CRT indications | | | | | | | | | | |
| | a. | CG 3722 | TRUNNION CDU DAC OUTPUT | -3.56±0.36V rms | | | | | | | |
| | b. | CG 3721 | SHAFT CDU DAC OUTPUT | +3.56±0.36V rms | | | | | | | |
| 6.2.20.3.33 | Insert in K148 | | | | | | | | | | |
| | a. | VERB 33 | ENTER | | | | | | | | |
| 6.2.20.3.34 | Observe on CRT | | | | | | | | | | |
| | a. | VO6 | N 02 | Flashing | | | | | | | |
| | b. | R1 | -00160 | | | | | | | | |
| | c. | R2 | +00160 | | | | | | | | |
| | d. | R3 | +00003 | | | | | | | | |
| 6.2.20.3.35 | Record CRT indications | | | | | | | | | | |
| | a. | CG 3722 | TRUNNION CDU DAC OUTPUT | -4.22±0.42V rms | | | | | | | |
| | b. | CG 3721 | SHAFT CDU DAC OUTPUT | +4.22±0.42V rms | | | | | | | |
| 6.2.20.3.36 | Insert in K148 | | | | | | | | | | |
| | a. | VERB 33 | ENTER | | | | | | | | |
| 6.2.20.3.37 | Observe on CRT | | | | | | | | | | |
| | a. | VO6 | N 02 | Flashing | | | | | | | |
| | b. | R1 | -00384 | | | | | | | | |
| | c. | R2 | +00384 | | | | | | | | |
| | d. | R3 | +00003 | | | | | | | | |

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- 6.2.20.3.38 Record CRT indications
- a. CG 3722 TRUNNION CIU DAC OUTPUT -10.12±1.00V rms
 - b. CG 3721 SHAFT CIU DAC OUTPUT +10.12±1.00V rms
- 6.2.20.3.39 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.40 Observe on CRT
- a. V06 N 02 Flashing
 - b. R1 -00385
 - c. R2 +00385
 - d. R3 +00003
- 6.2.20.3.41 Record CRT indications
- a. CG 3722 TRUNNION CIU DAC OUTPUT -10.12±1.00V rms
 - b. CG 3721 SHAFT CIU DAC OUTPUT +10.12±1.00V rms
- 6.2.20.3.42 Insert in K148
- a. V 34 ENTER
 - b. V 40 N 20 ENTER
 - c. V 41 N 20 ENTER
 - d. +00000 ENTER
 - e. +00000 ENTER
 - f. +00000 ENTER

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APPENDIX I

| Signal | Link | Nomenclature | G&N Test Requirement | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|-----------------------------|--|--|
| CG 1020 | 1 | +14 VDC CMC SUPPLY | +14.0±0.4 VDC | 0% |
| CG 1030 | 1 | +4 VDC CMC SUPPLY | +4.00±0.2 VDC | 0% |
| CG 1040 | 2 | +120 VDC PIPA SUPPLY | +120±6.0 VDC | 1% |
| CG 1051 | 1 | +20 VDC PIPA SUPPLY | +20.0±1.2 VDC | 0% |
| CG 1052 | 1 | -20 VDC PIPA SUPPLY | -20±2 VDC | 0% |
| CG 1070 | 1 | +4 VDC CDU SUPPLY | +4.0±0.2 VDC | 0% |
| CG 1100 | 1 | -28 VDC SUPPLY | -27.5±6.0 VDC | 0% |
| CG 1110 | 2 | 2.5 VDC TM BIAS | +2.50±0.05 VDC | 0% |
| CG 1201 | 2 | IMU 28V .8KC 1% 0° RMS | 28.00±0.56 VRMS | 1% |
| CG 1202 | 1 | IMU 28V .8KC 5% - 90° RMS | 28.0±1.4 VRMS | 1.5% |
| CG 1203 | 1 | IMU 28V .8KC 0° RMS | 28.0±2.1 VRMS | 1.5% |
| CG 1207 | 1 | PH DIFF IMU 5% 0°, -90° | -90±10° | 3% |
| CG 1211 | 1 | OPTX 28V .8KC 1% 0° RMS | 28.00±0.56 VRMS | 1.5% |
| CG 1212 | 1 | OPTX 28V .8KC 5% - 90° RMS | 28.00±1.48 VRMS | 1.5% |
| CG 1220 | 1 | PH DIFF OPTX 1% IMU 1% | 0° ±10° | 3% |
| CG 1331 | 2 | 3.2 KC 28V SUPPLY | 28.6±0.56 VRMS | 1% |
| CG 1336 | 1 | PH DIFF 3.2 KC 28V/CMC SYNC | 0° ±10° | 3% |
| CG 1500 | 1 | +28 VDC IMU OPERATE BUS | 28.8±3 VDC | 0% |
| CG 1510 | 1 | +28 VDC IMU STANDBY BUS | 28.8±3 VDC | 0% |
| CG 1520 | 1 | +28 VDC CMC OPERATE BUS | 28.8±3 VDC | 0% |
| CG 1530 | 1 | +28 VDC OPTX OPERATE BUS | 28.8±3 VDC | 0% |
| CG 2001 | 2 | X PIPA SG O/P | 5 VRMS max | 3% |
| CG 2021 | 2 | Y PIPA SG O/P | 5 VRMS max | 3% |
| CG 2041 | 2 | Z PIPA SG O/P | 5 VRMS max | 3% |
| CG 2108 | 1 | IG SERVO ERROR QUAD | 0.0±1.2 VRMS | 3% |
| CG 2112 | 2 | IG 1X RESOLVER O/P SIN | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2113 | 2 | IG 1X RESOLVER O/P COS | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2117 | 2 | IG SERVO ERROR IN PHASE | 0.0±60 mv RMS @ null | 2% |
| CG 2120 | 1 | IG TORQUE MOTOR CURRENT | 0.125 amp max during Fine Alignment Torquing | 0% |
| CG 2138 | 1 | MG SERVO ERROR QUAD | 0.0±1.2 VRMS | 3% |
| CG 2142 | 2 | MG 1X RESOLVER O/P SIN | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2143 | 2 | MG 1X RESOLVER O/P COS | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2147 | 2 | MG SERVO ERROR IN PHASE | 0.0±60 mv rms @ null | 2% |
| CG 2150 | 1 | MG TORQUE MOTOR CURRENT | 0.125 amp max during Fine Align Torquing | 0% |
| CG 2168 | 1 | OG SERVO ERROR QUAD | 0.0±1.2 VRMS | 3% |
| CG 2172 | 2 | OG 1X RESOLVER O/P SIN | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2173 | 2 | OG 1X RESOLVER O/P COS | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2177 | 2 | OG SERVO ERROR IN PHASE | 0.0±60 mv RMS @ null | 2% |
| CG 2180 | 1 | OG TORQUE MOTOR CURRENT | 0.125 amp max during Fine Align Torquing | 0% |
| CG 2219 | 1 | PITCH ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS @ 17° | 2% |
| CG 2220 | 1 | IG CDU FINE ERROR | 0.0±0.7 VRMS @ null | 1% |

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| Signal | Link | Nomenclature | G&N Test Requirement | PSAAM and/or SCA Uncertainty % of Full Scale |
| CG 2221 | 1 | IG CDU COARSE ERROR | 0.0±0.68 VRMS @ null | 1% |
| CG 2249 | 1 | YAW ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS @ 17° | 2% |
| CG 2250 | 1 | MG CDU FINE ERROR | 0.0±0.7 VRMS @ null | 1% |
| CG 2251 | 1 | MG CDU COARSE ERROR | 0.0±0.68 VRMS @ null | 1% |
| CG 2279 | 1 | ROLL ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS @ 17° | 2% |
| CG 2280 | 1 | OG CDU FINE ERROR | 0.0±0.07 VRMS @ null | 1% |
| CG 2281 | 1 | OG CDU COARSE ERROR | 0.0±0.68 VRMS | 1% |
| CG 2300 | 2 | PIPA TEMPERATURE | 130.5±1.5°F Operate Mode | 2% |
| CG3011 | 1 | TRUNNION CDU FINE ERROR | 0.0±0.07 VRMS @ null | 1% |
| CG 3021 | 1 | SHAFT CDU FINE ERROR | 0.0±0.07 VRMS @ null | 1% |
| CG 3117 | 1 | SXT SHAFT SERVO ERROR IN PH | 2 VRMS max | 2% |
| CG 3118 | 1 | SXT TRUNNION SERVO ERROR IN PHASE | 2 VRMS max | 2% |
| CG 3140 | 1 | SXT SHAFT TACH O/P | 3.3±1.3 VRMS @ Hi Rate | 2% |
| CG 3145 | 1 | SXT SHAFT MTR CONTROL WINDING | 3.3±1.3 VRMS @ Hi Rate | 2% |
| CG 3150 | 1 | SXT TRUNNION TACH O/P | 3.3±1.3 VRMS @ Hi Rate | 2% |
| CG 3155 | 1 | SXT TRUNNION MTR CONTROL WIND-0.85±0.35 VRMS at Hi Rate | 0.85±0.35 VRMS at Hi Rate | 2% |
| CG 3160 | 1 | SCT SHAFT TACH O/P | 3.3±1.3 VRMS @ Hi Rate | 2% |
| CG 3170 | 1 | SCT TRUNNION TACH O/P | 0.85±0.35 VRMS @ Hi Rate | 2% |
| CG 3721 | 2 | SHAFT CDU DAC O/P | 10.12±1.00 VRMS @ 17° | 1% |
| CG 3722 | 2 | TRUNNION CDU DAC O/P | 10.12±1.00 VRMS @ 17° | 1% |
| CG 4300 | 1 | CMC TEMP | 87.5±42.5°F | 0% |
| CG 6020 | 1 | PIPA CAL MODULE TEMP | 72.5±27.5°F | 0% |
| CG 6021 | 1 | IMU 800 cps 5% TEMP (PSA) | 90±30°F | 0% |
| CG 2301 | 1 | IRIG TEMPERATURE | 135±2.5°F in Operate | 2% |
| CG 1021 | 1 | +14V CMC SUPPLY NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1031 | 1 | +4V CMC SUPPLY NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1042 | 1 | +120 VDC PIPA SUP NOISE RMS | 1.5 VRMS MAX | 0% |
| CG 1053 | 1 | +20 VDC PIPA SUP NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1071 | 1 | +4 VDC CDU SUP NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1501 | 1 | +28V IMU OPERATE BUS NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1511 | 1 | +28V IMU STANDBY BUS NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1521 | 1 | +28V CMC OPERATE BUS NOISE RMS | 2.0 VRMS MAX | 0% |
| CG 1531 | 1 | +28V OPTX OPERATE BUS NOISE RMS | 2.0 VRMS MAX | 0% |

PSAAM OUTPUT is the source of Link 1 signals. SCA OUTPUT is the source of Link 2 signals.

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ADDENDUM II
COLOSSUS G&N System Tests

- Change 1 Delete the following sections or paragraphs when Colossus ropes are installed in the S/C.
- a. 6.2.1.3.9 thru 6.2.1.3.10.3
 - b. 6.2.2.1 thru 6.2.2.2.2
 - c. 6.2.2.7.1 "a" and "b" only
 - d. 6.2.2.11 thru 6.2.2.11.4
 - e. 6.2.5.2.7 thru 6.2.5.2.8.2 (a, b and c)
 - f. 6.2.5.3.6 second sentence and "a" and "b".
- Change 2 Substitute this paragraph for paragraph 6.2.5.1.3.1 when Colossus flight ropes are installed in the S/C.
- 6.2.5.1.3.1 On K-148 enter the following:
- VERB 21 NOUN 01 ENTR
00034 ENTR
00000 ENTR
Verify GIMBAL LOCK and PGNS CAUTION lights go out.
- VERB 21 NOUN 01 ENTR
00773 ENTR
40000 ENTR
- Verify that NO ATT indication is OFF.
- Change 3 Replace Figure 1 and Table I and II with the following when Colossus flight ropes are installed in the S/C.
- See Attachment.

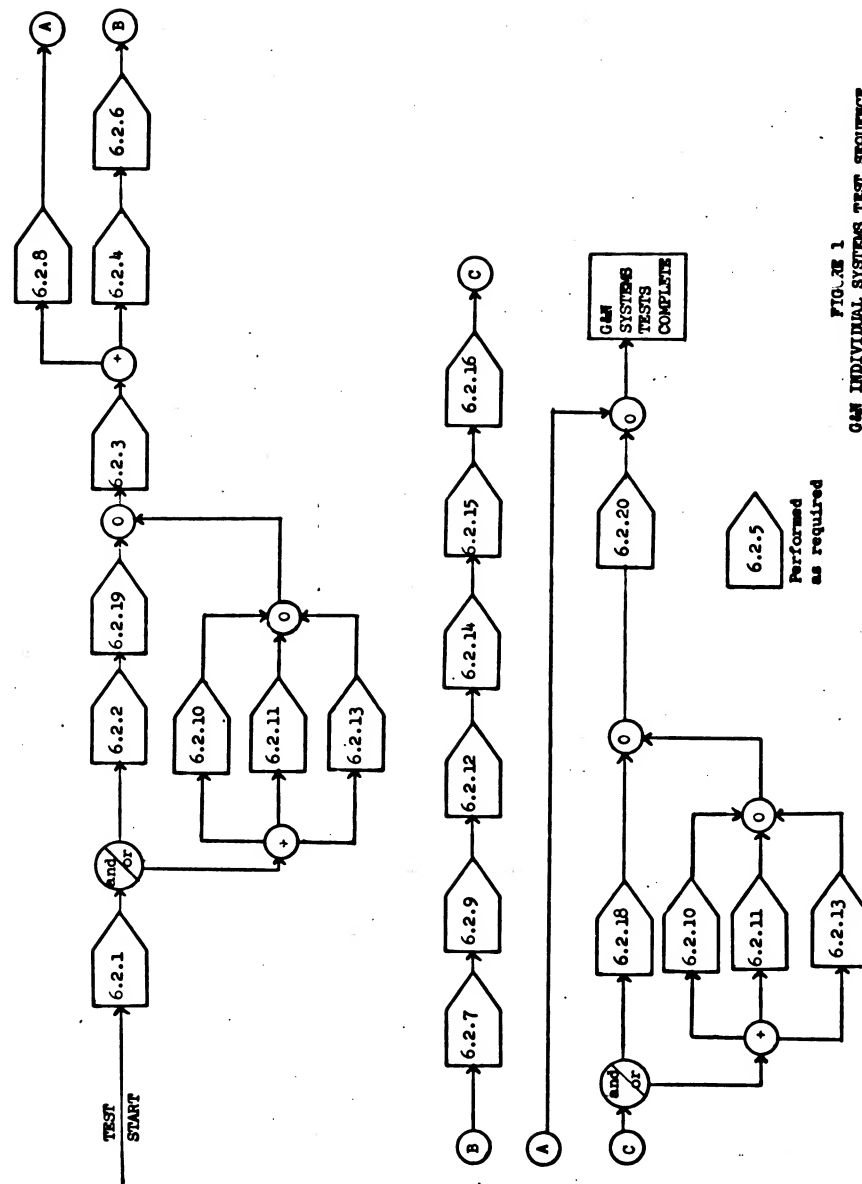


FIG. 2E 1
GJM INDIVIDUAL SYSTEMS TEST SEQUENCE

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TABLE I

| Paragraph No. | Test Title |
|---------------|--|
| 6.2.1 | Application of Standby Power to G&N System |
| 6.2.2 | CMC Operational Test |
| 6.2.3 | Operate Power On Test |
| 6.2.4 | G&N Power Supplies Test |
| 6.2.5 | General Turn Off and Turn On Procedures |
| 6.2.6 | G&N Operational Test |
| 6.2.7 | Gimbal Friction Test |
| 6.2.8 | G&N Panel Brightness & Lamp Test |
| 6.2.9 | Semi-Automatic Mode Control Test |
| 6.2.10 | Zero Optics Test |
| 6.2.11 | Optics Coordinate Transformation Control Test |
| 6.2.12 | Optics Function Test - VAB and PAD |
| 6.2.13 | Optics Slew Rate Test |
| 6.2.14 | Stabilization Loop Step Response Test |
| 6.2.15 | IRIG Scale Factor Test |
| 6.2.16 | IMU Performance Test |
| 6.2.18 | Gyrocompassing Test |
| 6.2.19 | Voltage Margin Test |
| 6.2.20 | S/C Control & Display Test |
| Change 4 | Delete section 6.2.17 Fine Alignment Test. |
| Change 5 | The following procedure replaces paragraph 6.2.6 when Colossus ropes are installed in the S/C. NOTE: Manual DSKY entries during this test may result in a test abort. |
| 6.2.6 | G&N Operational Test |
| 6.2.6.1 | Verify K-START tape F09CXXX-K105XX-00 CM/G/N OPCHK is on K-START tape reader. |
| 6.2.6.2 | E-Memory Program Load. |
| 6.2.6.2.1 | Start tape reader. |

TABLE II. RETEST MATRIX

| Paragraph Number | Test Title | IMU | NAV BASE | OPTICS | CMC | PSA | LEB DSKY | MDC DSKY | SIG. COND. | CDU | GAM HARNESS | PIPA ELUCT. | INDICATOR CONTROL PANEL |
|------------------|--|-----|----------|--------|-----|-----|----------|----------|------------|-----|-------------|-------------|-------------------------|
| 5.5.1 | ACC Ground Check | | | | X | | | | | | | | |
| 6.2.1 | Application of Standby Power to GAM System | X | X | | X | X | X | X | X | X | X | X | |
| 6.2.5 | General Turn Off and Turn On Procedure | * | X | * | * | * | * | * | * | * | * | * | * |
| 6.2.3 | Operate Power On Test | X | X | | X | X | X | X | X | X | X | X | |
| 6.2.2 | CMC Operational Test | | | | X | X | X | X | X | X | X | X | |
| 6.2.8 | GAM Panel Brightness and Lamp Test | X | X | X | X | X | X | X | X | X | X | X | |
| 6.2.6 | GAM Operational Test | X | X | X | X | X | X | X | X | X | X | X | |
| 6.2.10 | Zero Optics Test | | X | X | X | X | X | X | X | X | X | X | |
| 6.2.13 | Optics Slew Rate Test | | X | X | X | X | X | X | X | X | X | X | |
| 6.2.11 | Optics Coordinate Transformation Control | | X | X | X | X | X | X | X | X | X | X | |
| 6.2.12 | Optics Function Test - VAB and PAD | | X | X | X | X | X | X | X | X | X | X | |
| 6.2.9 | Semi-Automatic Mode Control Test | X | X | X | X | X | X | X | X | X | X | X | |
| 6.2.14 | Stab Loop Step Response Test | X | X | X | X | X | X | X | X | X | X | X | |
| 6.2.15 | IRIG Scale Factor Test | X | X | X | X | X | X | X | X | X | X | X | |
| 6.2.16 | IMU Performance Test | X | X | X | X | X | X | X | X | X | X | X | |
| 6.2.19 | Voltage Margin Test | | X | X | X | X | X | X | X | X | X | X | |
| 6.2.7 | Gimbal Friction Test | X | X | X | X | X | X | X | X | X | X | X | |
| 6.2.16 | Gyrocompassing Test | X | X | X | X | X | X | X | X | X | X | X | |
| 6.2.4 | GAM Power Supplies Test | | X | X | X | X | X | X | X | X | X | X | |
| 6.2.20 | S/C Control & Display Test | | X | X | X | X | X | X | X | X | X | X | |

* To be used as necessary to turn system on and off.

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| 6.2.6.2.2 | | |
| When tape reader stops verify that CRT DSKY Row 1 and Row 2 indicate the same numbers. | | |
| 6.2.6.2.3 | | |
| Repeat above two steps X times. | | |
| 6.2.6.3 | | |
| Local g measurement. | | |
| 6.2.6.3.1 | | |
| Start tape reader. | | |
| 6.2.6.3.2 | | |
| In approximately 15 minutes VERB 06 NOUN 98 shall flash. | | |
| 6.2.6.3.3 | | |
| From the CRT DSKY display read and record Row 1 and Row 2 (local gravity whole and fractional respectively). The value recorded shall be between 975.0 and 985.0 cm/sec ² . | | |
| 6.2.6.4 | | |
| Horizontal earth rate measurement. | | |
| 6.2.6.4.1 | | |
| Start tape reader. | | |
| 6.2.6.4.2 | | |
| VERB 06 NOUN 98 shall flash. | | |
| 6.2.6.4.3 | | |
| From the CRT DSKY display read and record R2 (horizontal component of earth rate acting on X, Y, and Z IRIG's). The values recorded shall be between 78000 and 98000. | | |
| 6.2.6.5 | | |
| Enter the following on K-148: | | |
| VERB 36 ENTR | | |
| VERB 41 NOUN 20 ENTR | | |
| +00000 ENTR | | |
| +00000 ENTR | | |
| +00000 ENTR | | |
| Change 6 | | |
| The following procedure replaces section 6.2.9 when Colossus ropes are installed in the S/C. | | |
| NOTE: Manual DSKY entries during this test may result in test abort. | | |
| 6.2.9 | | |
| Semi-Automatic Moding Check | | |
| Proceed with this test if 6.2.2.3 has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 before proceeding with this test. | | |
| 6.2.9.1 | | |
| Test Initiation | | |
| 6.2.9.1.1 | | |
| Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify OPTX BUS, 28V 800mA 1% and 5% Power Supplies. | | |

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- 6.2.9.1.2 Enter the following into the DSKY.
a. VERB 01 NOUN 01, ENTER
b. 01323, ENTER
Record R1 = XXXXY
- 6.2.9.1.3 Enter the following into the DSKY.
a. VERB 21 NOUN 01, ENTER
b. 01323, ENTER
c. XXXXY', ENTER where Y' is determined by Table II and
XXXXY is that recorded in 6.2.9.1.2.

TABLE II

| | | | | | | | | |
|--------------------|---|---|---|---|---|---|---|---|
| Y (From 6.2.9.1.2) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Y' | 2 | 3 | 2 | 3 | 6 | 7 | 6 | 7 |

- 6.2.9.1.4 Verify that K-START tape F09CXXX-K105XX-00 Block II
SEMI-AUTOMATIC MODE TEST is on the K-START tape reader.
- 6.2.9.2 E-Memory Program Load.
- 6.2.9.2.1 Start tape reader.
- 6.2.9.2.2 When tape reader stops verify that the CRT DSKY Row 1 indicates +00001.
- 6.2.9.2.3 Start tape reader.
- 6.2.9.2.4 When the tape reader stops verify that the CRT DSKY Row 1 and Row 2
indicate the same numbers.
- 6.2.9.2.5 Repeat above two steps X times.
- 6.2.9.3 Command Accuracy 0°.
- 6.2.9.3.1 Start tape reader.
- 6.2.9.3.2 When the tape reader stops verify that the CRT DSKY Row 1 indicates
+00002 and that the NO ATT lamp is lighted.
- 6.2.9.3.3 Read and record the CRT indications of IMU gimbal angles. The indications
shall be 000 ± 001 degrees.
- 6.2.9.3.4 Read and record the CRT indication of the CDU registers. The indications
shall be $+000.00 \pm 0.30$ degrees.
- 6.2.9.4 Command Accuracy 45°.
- 6.2.9.4.1 Start tape reader.

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- 6.2.9.4.2 When the tape reader stops verify that the CRT DSKY Row 1 indicates +00003.
- 6.2.9.4.3 Read and record the CRT indications of IMU gimbal angles. The indications shall be 045 ± 001 degrees.
- Read and record the CRT indication of the CDU registers. The indications shall be $+045.00 \pm 0.30$ degrees.
- 6.2.9.5 CDU Repeating Accuracy 45° .
- 6.2.9.5.1 Start tape reader.
- 6.2.9.5.2 In approximately 95 seconds the VERB/NOUN display shall flash. Verify that the CRT DSKY Row 1 indicates +00004.
- 6.2.9.5.3 Start tape reader.
- 6.2.9.5.4 When the tape reader stops read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.
- 6.2.9.6 + Gimbal Lock test.
- 6.2.9.6.1 Start tape reader.
- 6.2.9.6.2 When the tape reader stops verify that the CRT DSKY Row 1 indicates +00005 and that the Gimbal Lock lamp is lighted.
- 6.2.9.7 Command Accuracy 90° .
- 6.2.9.7.1 Start tape reader.
- 6.2.9.7.2 When the tape reader stops verify that the CRT DSKY Row 1 indicates +00006 and that the Gimbal Lock lamp is lighted.
- 6.2.9.7.3 Read and record the CRT indications of IMU gimbals angles. The indications shall be 090 ± 001 degrees.
- 6.2.9.7.4 Read and record the CRT indication of the CDU registers. The indications shall be $+090.00 \pm 0.30$ degrees.
- 6.2.9.8 Command Accuracy 135° .
- 6.2.9.8.1 Start tape reader.
- 6.2.9.8.2 When the tape reader stops verify that the CRT DSKY Row 1 indicates +00007 and that the Gimbal Lock lamp is lighted.

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| 6.2.9.8.3 | | |
| Read and Record the CRT indications of IMU gimbal angles. The indications shall be 135 ± 001 degrees. | | |
| 6.2.9.8.4 | | |
| Read and record the CRT indication of the CDU registers. The indications shall be $+135.00 \pm 0.30$ degrees. | | |
| 6.2.9.9 | | |
| Gimbal Lock removal. | | |
| 6.2.9.9.1 | | |
| Start tape reader. | | |
| 6.2.9.9.2 | | |
| When the tape reader stops verify that the CRT DSKY Row 1 indicates +00008 and that the Gimbal Lock lamp is not lighted. | | |
| 6.2.9.10 | | |
| CDU Repeating Accuracy 135° . | | |
| 6.2.9.10.1 | | |
| Start tape reader. | | |
| 6.2.9.10.2 | | |
| In approximately 95 seconds the VERB/NOUN display shall flash. Verify that the CRT DSKY Row 1 indicates +00009. | | |
| 6.2.9.10.3 | | |
| Start tape reader. | | |
| 6.2.9.10.4 | | |
| When the tape reader stops read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003. | | |
| 6.2.9.11 | | |
| Command Accuracy 225° . | | |
| 6.2.9.11.1 | | |
| Start tape reader. | | |
| 6.2.9.11.2 | | |
| When the tape reader stops verify that the CRT DSKY Row 1 indicates +00010 and that the Gimbal Lock lamp is lighted. | | |
| 6.2.9.11.3 | | |
| Read and record the CRT indications of IMU gimbal angles. The indications shall be 225 ± 001 degrees. | | |
| Read and record the CRT indication of the CDU registers. The indications shall be $+225.00 \pm 0.30$ degrees. | | |
| 6.2.9.12 | | |
| Gimbal Lock Removal and CDU Repeating Accuracy 225° , 225° , and 315° (IG, OG and MG respectively). | | |
| 6.2.9.12.1 | | |
| Start tape reader. | | |
| 6.2.9.12.2 | | |
| When the tape reader stops verify that the CRT DSKY Row 1 indicates +00011 and that the Gimbal Lock lamp is not lighted. | | |
| 6.2.9.12.3 | | |
| Read and record the CRT indication of IMU gimbal angles. The indications shall be 225 ± 001 , 225 ± 001 and 315 ± 001 degrees for the IG, OG and MG angles respectively. | | |

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- 6.2.9.12.4 Read and record the CRT indications of the CDU registers. The indications shall be 225.00 ± 0.30 , 225.00 ± 0.30 and 315.00 ± 0.30 degrees for the IG, OG and MG angles respectively.
- 6.2.9.12.5 Start tape reader.
- 6.2.9.12.6 In approximately 95 seconds the VERB/NOUN display shall flash. Wait for VERB/NOUN display to flash before proceeding.
- 6.2.9.12.7 Start tape reader.
- 6.2.9.12.8 When the tape reader stops read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.
- 6.2.9.13 Command Accuracy 315° .
- 6.2.9.13.1 Start tape reader.
- 6.2.9.13.2 When the tape reader stops verify that the CRT DSKY Row 1 indicates +00012.
- 6.2.9.13.3 Read and record the CRT indications of IMU gimbal angles. The indications shall be 315 ± 001 degrees.
- 6.2.9.13.4 Read and record the CRT indication of the CDU registers. The indications shall be $+315.00 \pm 0.30$ degrees.
- 6.2.9.14 CDU Repeating Accuracy 315° .
- 6.2.9.14.1 Start tape reader.
- 6.2.9.14.2 In approximately 95 seconds the VERB/NOUN display shall flash. Verify that the CRT DSKY Row 1 indicates +00013.
- 6.2.9.14.3 Start tape reader.
- 6.2.9.14.4 When the tape reader stops read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.
- 6.2.9.15 -Gimbal Lock Test.
- 6.2.9.15.1 Start tape reader.
- 6.2.9.15.2 When the tape reader stops verify that the CRT DSKY Row 1 indicates +00014 and that the Gimbal Lock lamp is lighted.
- 6.2.9.15.3 Read and record the CRT indications of IMU gimbal angles. The indications shall be 289 ± 001 degrees.

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- 6.2.9.15.4 Read and record the CRT indication of the CDU registers. The indications shall be $+289.00 \pm 0.30$ degrees.
- 6.2.9.16 -Gimbal Lock Removal.
- 6.2.9.16.1 Start tape reader.
- 6.2.9.16.2 When the tape reader stops verify that the CRT DSKY Row 1 indicates +00015. Wait 25 seconds before proceeding.
- 6.2.9.16.3 Verify that the Gimbal Lock lamp is not lighted.
- 6.2.9.16.4 Read and record the CRT indication of IMU gimbal angles. The indications shall be 000 ± 001 degrees.
- 6.2.9.16.5 Read and record the CRT indication of the CDU registers. The indications shall be $+000.00 \pm 0.30$ degrees.
- 6.2.9.17 CDU Command Rate Test.
- 6.2.9.17.1 Start tape reader.
- 6.2.9.17.2 When the tape reader stops verify that the CRT DSKY Row 1 indicates +00016.
- 6.2.9.17.3 In approximately 60 sec verify that the Gimbal Lock lamp lights. Wait for the VERB/NOUN display to flash before proceeding.
- 6.2.9.17.4 Start tape reader.
- 6.2.9.17.5 When the tape reader stops read and record the MG CDU Drive Rate displayed on the CRT DSKY Row 1 (000XX deg/sec).
- 6.2.9.17.6 Start the tape reader.
- 6.2.9.17.7 When the tape reader stops read and record the fractional MG CDU Drive Rate display on the CRT DSKY Row 1 (.XXXXX deg/sec).
- 6.2.9.17.8 The MG CDU Drive Rate ($MG = R1$ (whole). $R1$ (fractional) deg/sec) shall be 14 ± 2 deg/sec.
- 6.2.9.17.9 Start tape reader.
- 6.2.9.17.10 Wait for the VERB/NOUN display to flash before proceeding.
- 6.2.9.17.11 Start tape reader.
- 6.2.9.17.12 When the tape reader stops read and record the OG CDU Drive Rate displayed on the CRT DSKY Row 1 (000XX deg/sec).

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- 6.2.9.17.13 Start the tape reader.
- 6.2.9.17.14 When the tape reader stops read and record the fractional OG CDU Drive Rate display on the CRT DSKY Row 1 (.XXXXX deg/sec).
- 6.2.9.17.15 The OG CDU Drive Rate (OG = R1 (whole), R1 (fractional) deg/sec) shall be 14 ± 2 deg/sec.
- 6.2.9.17.16 Start tape reader.
- 6.2.9.17.17 Wait for the VERB/NOUN display to flash before proceeding.
- 6.2.9.17.18 Start tape reader.
- 6.2.9.17.19 When the tape reader stops read and record the IG CDU Drive Rate displayed on the CRT DSKY Row 1 (000XX deg/sec).
- 6.2.9.17.20 Start the tape reader.
- 6.2.9.17.21 When the tape reader stops read and record the fractional IG CDU Drive Rate display on the CRT DSKY Row 1 (.XXXXX deg/sec).
- 6.2.9.17.22 The IG CDU Drive Rate (IG = R1 (whole), R1 (fractional) deg/sec) shall be 14 ± 2 deg/sec. Wait 30 sec before proceeding.
- 6.2.9.18 OG Fine Fail Test.
- 6.2.9.18.1 Start tape reader.
- 6.2.9.18.2 When the tape reader stops verify that the NO ATT lamp is lighted and that the ISS WARNING lamp is not lighted.
- 6.2.9.18.3 Verify that the CRT DSKY Row 1 indicates 00021 and Row 2 indicates 27XXX.
- 6.2.9.18.4 Start tape reader.
- 6.2.9.18.5 In approximately 50 seconds the ISS WARNING lamp shall light. Wait for the VERB/NOUN display to flash before proceeding.
- 6.2.9.18.6 Start tape reader.
- 6.2.9.18.7 When the tape reader stops verify that the NO ATT lamp is not lighted and that the CRT DSKY Row 1 indicates 00021 and Row 2 indicates 33XXX.
- 6.2.9.18.8 Verify that the ISS WARNING lamp extinguishes.
- 6.2.9.19 IG Fine Fail Test.

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- 6.2.9.19.1 Start tape reader.
- 6.2.9.19.2 When the tape reader stops verify that the NO ATT lamp is lighted and that the ISS WARNING lamp is not lighted.
- 6.2.9.19.3 Verify that the CRT DSKY Row 1 indicates 00022 and Row 2 indicates 27XXX.
- 6.2.9.19.4 Start tape reader.
- 6.2.9.19.5 In approximately 50 seconds the ISS WARNING lamp shall light. Wait for the VERB/NOUN display to flash before proceeding.
- 6.2.9.19.6 Start tape reader.
- 6.2.9.19.7 When the tape reader stops verify that the NO ATT lamp is not lighted and that the CRT DSKY Row 1 indicates 00022 and Row 2 indicates 33XXX.
- 6.2.9.19.8 Verify that the ISS WARNING lamp extinguishes.
- 6.2.9.20 MG Fine Fail Test.
- 6.2.9.20.1 Start tape reader.
- 6.2.9.20.2 When the tape reader stops verify that the NO ATT lamp is lighted and that the ISS WARNING lamp is not lighted.
- 6.2.9.20.3 Verify that the CRT DSKY Row 1 indicates 00023 and Row 2 indicates 27XXX.
- 6.2.9.20.4 Start tape reader.
- 6.2.9.20.5 In approximately 50 seconds the ISS WARNING lamp shall light. Wait for the VERB/NOUN display to flash before proceeding.
- 6.2.9.20.6 Start tape reader.
- 6.2.9.20.7 When the tape reader stops verify that the NO ATT lamp is not lighted and that the CRT DSKY Row 1 indicates 00023 and Row 2 indicates 33XXX.
- 6.2.9.20.8 Verify that the ISS WARNING lamp extinguishes.
- 6.2.9.21 OG Coarse Fail Test.
- 6.2.9.21.1 Start tape reader.
- 6.2.9.21.2 When the tape reader stops verify that the NO ATT lamp is lighted and that the ISS WARNING lamp is not lighted.

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- 6.2.9.21.3 Verify that the CRT DSKY Row 1 indicates 00024 and Row 2 indicates 27XXX.
- 6.2.9.21.4 Start tape reader.
- 6.2.9.21.5 In approximately 50 seconds the ISS WARNING lamp shall light. Wait for the VERB/NOUN display to flash before proceeding.
- 6.2.9.21.6 Start tape reader.
- 6.2.9.21.7 When the tape reader stops verify that the NO ATT lamp is not lighted and that the CRT DSKY Row 1 indicates 00024 and Row 2 indicates 33XXX.
- 6.2.9.21.8 Verify that the ISS WARNING lamp extinguishes.
- 6.2.9.22 IG Coarse Fail Test.
- 6.2.9.22.1 Start tape reader.
- 6.2.9.22.2 When the tape reader stops verify that the NO ATT lamp is lighted and that the ISS WARNING lamp is not lighted.
- 6.2.9.22.3 Verify that the CRT DSKY Row 1 indicates 00025 and Row 2 indicates 27XXX.
- 6.2.9.22.4 Start tape reader.
- 6.2.9.22.5 In approximately 50 seconds the ISS WARNING lamp shall light. Wait for the VERB/NOUN display to flash before proceeding.
- 6.2.9.22.6 Start tape reader.
- 6.2.9.22.7 When the tape reader stops verify that the NO ATT lamp is not lighted and that the CRT DSKY Row 1 indicates 00025 and Row 2 indicates 33XXX.
- 6.2.9.22.8 Verify that the ISS WARNING lamp extinguishes.
- 6.2.9.23 MG Coarse Fail Test.
- 6.2.9.23.1 Start tape reader.
- 6.2.9.23.2 When the tape reader stops verify that the NO ATT lamp is lighted and that the ISS WARNING lamp is not lighted.
- 6.2.9.23.3 Verify that the CRT DSKY Row 1 indicates 00026 and Row 2 indicates 27XXX.
- 6.2.9.23.4 Start tape reader.
- 6.2.9.23.5 In approximately 50 seconds the ISS WARNING lamp shall light. Wait for the VERB/NOUN display to flash before proceeding.

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| 6.2.9.24.16 | | |

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- 6.2.9.24.17 When the tape reader stops read and record the fractional Trunnion Optics CDU Drive Rate display on the CRT DSKY Row 1 (.XXXXX deg/sec).
- 6.2.9.24.18 The Trunnion Optics CDU Drive Rate (Trunnion Rate = R1 (whole). R1 (fractional) deg/sec) shall be 1.83 ± 0.5 deg/sec. Wait 50 sec before proceeding.
- 6.2.9.24.19 If optics testing will not continue, set the G/N POWER OPTICS switch on the LEB Lighting Control Panel to OFF.
- Change 7 The following procedure replaces paragraph 6.2.15 when COLOSSUS flight ropes are installed in the S/C.
- 6.2.15 IRIG Scale Factor Test.
- Test will be run with E-Memory program. Program to be put on K-START tape. Procedure to be supplied when available.
- Change 8 The following procedure replaces paragraph 6.2.16 when COLOSSUS flight ropes are installed in the S/C.
- 6.2.16 IMU Performance test. A reference data sheet is provided at the end of this section to aid in data reduction.
- 6.2.16.1 Perform Master Initialization 6.2.5.3 before proceeding.
- 6.2.16.2 On K-148 enter the following:
- | | | |
|---------|---------|------|
| VERB 01 | NOUN 10 | ENTR |
| 00003 | | ENTR |
- Record CRT DSKY Row 1 indication AAAAA and the time of day.
- 6.2.16.3 On K-148 enter the following:
- | | | |
|---------|---------|------|
| VERB 21 | NOUN 01 | ENTR |
| 02100 | | ENTR |
| AAAAA | | ENTR |
| VERB 06 | NOUN 02 | ENTR |
| 02100 | | ENTR |
- Record CRT DSKY Row 1 indications as ±BBBBB.

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- 6.2.16.4 Perform the following calculations:
- $\frac{BBBBB \times 5.12}{3600} = CCCC.C$ (Contents (hrs) of high order scalar register)
 - $23.3 - CCCC.C = DDDD.D$ hours.
 - $DDDD.D + \text{present time of day} = \text{time of day at which high order scalar register will overflow.}$
- 6.2.16.5 If the time of day is within 12 minutes of that calculated in 6.3.16.4.c when about to perform any of the following paragraphs, wait until that time calculated in 6.2.16.4.c has passed and proceed.
- 6.2.16.8.6
 - 6.2.16.9.6
 - 6.2.16.10.6
 - 6.2.16.11.6
 - 6.2.16.12.4
 - 6.2.16.13.4
- 6.2.16.6 Deleted
- 6.2.16.7 E-Memory Load.
- 6.2.16.7.1 Start tape reader.
- 6.2.16.7.2 When tape reader stops enter the following on K-148:
- VERB 05 NOUN 01 ENTR
 XXXXX ENTR
- NOTE: XXXXX is the third last location of the E-Memory Program load. (To be specified when available).
- 6.2.16.7.3 Verify CRT DSKY display the following:
- Row 1 00033
 Row 2 00000
 Row 3 00000
- 6.2.16.8 Position 1 Stable Member Matrix Load.
- 6.2.16.8.1 Start tape reader.
- 6.2.16.8.2 When tape reader stops enter the following on K-148:
- VERB 92 ENTR
- 6.2.16.8.3 Observe VERB 21 NOUN 01 flashing. On K-148 enter the following:
- +XXX.XX ENTR (Correct navigation base azimuth ± 0.50 deg.)
 +28.516 ENTR (Correct test site latitude.)
 Verify values in R1 and R2 are correct.

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- 6.2.16.8.4 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.8.5 In approximately 12 minutes, VERB 06 NOUN 98 shall flash. From the CRT, DSKY display, record +NBDY (position +00001) .
- 6.2.16.8.6 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.8.7 In approximately 6 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY, record R1 and R2 +X PIPA 1g (position +00001) . Row 1 is whole part, Row 2 is fractional part.
- 6.2.16.8.8 Enter the following on K-148:
VERB 36 ENTR
- 6.2.16.9 Position 2 Stable Member Matrix Load.
- 6.2.16.9.1 Start tape reader.
- 6.2.16.9.2 When tape reader stops enter the following on K-148:
VERB 92 ENTR
- 6.2.16.9.3 Observe VERB 21 NOUN-01 flashing. On K-148 enter the following:
+XXX.XX ENTR (Correct navigation base azimuth ± 0.5 deg.)
+28.516 ENTR (Correct test site latitude)
Verify values in R1 and R2 are correct.
- 6.2.16.9.4 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.9.5 In approximately 12 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display record R2 [+NBDZ (position +00002)] .
- 6.2.16.9.6 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.9.7 In approximately 6 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY record R1 and R2 [-X PIPA 1g (position +00002)] . Row 1 is whole part, Row 2 is fractional part.

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- 6.2.16.9.8 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.9.9 In approximately 67 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY record R2 -NBDX + ADLAX (position +00002) .
- 6.2.16.9.10 Enter the following on K-148:
VERB 36 ENTR
- 6.2.16.10 Position 3 Stable Member Matrix Load.
- 6.2.16.10.1 Start tape reader.
- 6.2.16.10.2 When tape reader stops enter the following on K-148:
VERB 92 ENTR
- 6.2.16.10.3 Observe VERB 21 NOUN 01 flashing. On K-148 enter the following:
+XXX.XX ENTR (Correct navigation base azimuth ± 0.5 deg)
+28.516 ENTER (Correct test site latitude)
Verify values in R1 and R2 are correct.
- 6.2.16.10.4 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.10.5 In approximately 12 minutes, VERB 06 NOUN 98 shall flash. From the CRT, DSKY display, record R2 -NBDX (position 3) .
- 6.2.16.10.6 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.10.7 In approximately 6 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY, record R1 and R2 +Z PIPA 1g (position +00003) .
Row 1 is whole part, Row 2 is fractional part.
- 6.2.16.10.8 Enter the following on K-148:
VERB 36 ENTR
- 6.2.16.11 Position 4 Stable Member Matrix Load.
- 6.2.16.11.1 Start tape reader.

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- 6.2.16.11.2 When tape reader stops enter the following on K-148:
VERB 92 ENTR
- 6.2.16.11.3 Observe VERB 21 NOUN 01 flashing. On K-148 enter the following:
+XXX.XX ENTR (Correct navigation base azimuth ± 0.5 deg)
+28.516 ENTR (Correct test site latitude)
Verify values in R1 and R2 are correct.
- 6.2.16.11.4 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.11.5 In approximately 12 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY, record R2 [+NBDY + ADSRAY (position +00004)].
- 6.2.16.11.6 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.11.7 In approximately 6 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY record R1 and R2 [-Z PIPA 1g (position +00004)].
Row 1 is whole part, Row 2 is fractional part.
- 6.2.16.11.8 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.11.9 In approximately 67 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY record R2 [-NBDZ + ADIAZ (position +00004)].
- 6.2.16.11.10 Enter the following on K-148:
VERB 36 ENTR
- 6.2.16.12 Position 5 Stable Member Matrix load.
- 6.2.16.12.1 Start tape reader.
- 6.2.16.12.2 When tape reader stops enter the following on K-148:
VERB 92 ENTR
- 6.2.16.12.3 Observe VERB 21 NOUN 01 flashing on K-148 enter the following:
+XXX.XX ENTR (Correct navigation base azimuth ± 0.5 deg)
+28.516 ENTR (Correct test site latitude)
Verify values in R1 and R2 are correct.

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6.2.16.12.4 Enter the following on K-148:
VERB 33 ENTR

6.2.16.12.5 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.2.16.12.6 In approximately 5 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY record R1 and R2 +Y PIPA (position +00005). Row 1 is whole part, Row 2 is fractional part.

6.2.16.12.7 Enter the following on K-148:
VERB 36 ENTR

6.2.16.13 Position 6 Stable Member Matrix Load.

6.2.16.13.1 Start tape reader.

6.2.16.13.2 When tape reader stops enter the following on K-148:
VERB 92 ENTR

6.2.16.13.3 Observe VERB 21 NOUN 01 flashing. On K-148 enter the following:
+XXX.XX ENTR (Correct navigation base azimuth ± 0.5 deg)
+28.516 ENTR (Correct test site latitude)
Verify values in R1 and R2 are correct.

6.2.16.13.4 Enter the following on K-148:
VERB 33 ENTR

6.2.16.13.5 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.

6.2.16.13.6 In approximately 5 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY record R1 and R2 -Y PIPA (position +00006). Row 1 is whole part, Row 2 is fractional part.

6.2.16.13.7 Enter the following on K-148:
VERB 36 ENTR

6.2.16.14 Position 7 Stable Member Matrix Load.

6.2.16.14.1 Start tape reader.

6.2.16.14.2 When tape reader stops enter the following on K-148:
VERB 92 ENTR
00001 ENTR

6.2.16.14.3 Observe VERB 21 NOUN 01 flashing. On K-148 enter the following:
+XXX.XX ENTR (Correct navigation base azimuth ± 0.5 deg)
+28.516 ENTR (Correct test site latitude)
Verify values in R1 and R2 are correct.

6.2.16.14.4 Enter the following on K-148:
VERB 33 ENTR

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- 6.2.16.14.5 In approximately 12 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY record R2 ± 707 ADSRAX - NBDX (position +00007).
- 6.2.16.14.6 On K-148 enter the following:
- VERB 36 ENTR
- 6.2.16.15 Position 8 Stable Member Matrix Load.
- 6.2.16.15.1 Start tape reader.
- 6.2.16.15.2 When tape reader stops enter the following on K-148:
- VERB 92 ENTR
- 6.2.16.15.3 Observe VERB 21 NOUN 01 flashing. On K-148 enter the following:
- +XXX.XX ENTR (Correct navigation base azimuth ± 0.5 deg)
+28.516 ENTR (Correct test site latitude)
Verify values in R1 and R2 are correct.
- 6.2.16.15.4 Enter the following on K-148:
- VERB 33 ENTR
- 6.2.16.15.5 In approximately 12 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY record R2 ± 707 (NBDZ + NBDY) +0.5 (ADSRAY + ADSRAZ) +0.5 (ADIAZ - ADIAY) (position 8).
- 6.2.16.15.6 On K-148 enter the following:
- VERB 36 ENTR
- 6.2.16.16 Position 9 Stable Member Matrix Load.
- 6.2.16.16.1 Start tape reader.
- 6.2.16.16.2 When tape reader stops enter the following on K-148:
- VERB 92 ENTR
- 6.2.16.16.3 Observe VERB 21 NOUN 01 flashing. On K-148 enter the following:
- +XXX.XX ENTR (Correct navigation base azimuth ± 0.5 deg)
+28.516 ENTR (Correct test site latitude)
Verify values in R1 and R2 are correct.

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- 6.2.16.16.4 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.16.5 In approximately 12 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY record R2 .
- 6.2.16.16.6 On K-148 enter the following:
VERB 36 ENTR
- 6.2.16.17 Position 10 Stable Member Matrix Load.
- 6.2.16.17.1 Start tape reader.
- 6.2.16.17.2 When tape reader stops enter the following on K-148:
VERB 92 ENTR
- 6.2.16.17.3 Observe VERB 21 NOUN 01 flashing. On K-148 enter the following:
+XXX.XX ENTR (Correct navigation base azimuth ± 0.5 deg)
+28.516 ENTR (Correct test site latitude)
Verify values in R1 and R2 are correct.
- 6.2.16.17.4 Enter the following on K-148:
VERB 33 ENTR
- 6.2.16.17.5 In approximately 12 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY record R2 .
- 6.2.16.17.6 On K-148 enter the following:
VERB 36 ENTR
- Change 9 Voltage Margin Test, Section 6.2.19
- This test presently depends upon the use of the CMC Self Check routine which has been deleted for Colossus ropes.
Change to this test for Colossus ropes will be supplied when available.
- Change 10 The following procedure replaces paragraph 6.2.20 when COLOSSUS ropes are installed in the S/C.
- NOTE: Manual DSKY entries during this test may result in a test abort.

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- 6.2.20 Spacecraft Control and Displays Test.
- 6.2.20.1 Proceed with this test if the Operator Power On Test of 6.2.3 and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2 before proceeding.
- 6.2.20.1.1 Verify K-START tape F09CXXX-K105XX-00 CM S/C CONTROL and DISPLAY CHK is on K-START tape reader.
- 6.2.20.2 E-Memory Program Load.
- 6.2.20.2.1 Start tape reader.
- 6.2.20.2.2 When tape reader stops verify that CRT DSKY Row 1 and Row 2 indicate the same numbers.
- 6.2.20.2.3 Repeat above two steps X times.
- 6.2.20.3 FDAI Attitude Error.
- 6.2.20.3.1 Start Tape Reader.
- 6.2.20.3.2 When tape reader stops observe on CRT
- | | | |
|-------------------|-----|---------------|
| a. V06 | NO1 | Flashing |
| b. PROG | | 07 |
| c. NO ATT | | ON |
| d. R1, R2, and R3 | | Approx. 00000 |
- 6.2.20.3.3 Start tape reader.
- 6.2.20.3.4 When tape reader stops observe on CRT
- | | | |
|-----------|-----|----------|
| a. V06 | NO1 | Flashing |
| b. R1 | | +00385 |
| c. R2 | | -00385 |
| d. R3 | | +00385 |
| e. NO ATT | | OFF |
- 6.2.20.3.5 Record CRT indications
- | | |
|--|-----------------|
| a. CG 2279 ROLL ATT ERROR - CDU DAC OUT | +5.06±0.50 VRMS |
| b. CG 2219 PITCH ATT ERROR - CDU DAC OUT | -5.06±0.50 VRMS |
| c. CG 2249 YAW ATT ERROR - CDU DAC OUT | +5.06±0.50 VRMS |
- 6.2.20.3.6 Start tape reader.

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| 6.2.20.3.7 | When tape reader stops observe on CRT | |
| a. V06 | NO1 | Flashing |
| b. R1 | +00384 | |
| c. R2 | -00384 | |
| d. R3 | +00384 | |
| 6.2.20.3.8 | Record CRT indications | |
| a. CG 2279 ROLL ATT ERROR - CDU DAC OUT | | +5.06±0.50 VRMS |
| b. CG 2219 PITCH ATT ERROR - CDU DAC OUT | | -5.06±0.50 VRMS |
| c. CG 2249 YAW ATT ERROR - CDU DAC OUT | | +5.06±0.50 VRMS |
| 6.2.20.3.9 | Start Tape reader. | |
| 6.2.20.3.10 | When tape reader stops observe on CRT | |
| a. V06 | NO1 | Flashing |
| b. R1 | +00160 | |
| c. R2 | -00160 | |
| d. R3 | +00160 | |
| 6.2.20.3.11 | Record CRT indications: | |
| a. CG 2279 ROLL ATT ERROR - CDU DAC OUT | | +2.11±0.21 VRMS |
| b. CG 2219 PITCH ATT ERROR - CDU DAC OUT | | -2.11±0.21 VRMS |
| c. CG 2249 YAW ATT ERROR - CDU DAC OUT | | +2.11±0.21 VRMS |
| 6.2.20.3.12 | Start tape reader. | |
| 6.2.20.3.13 | When tape reader stops observe on CRT | |
| a. V06 | NO1 | Flashing |
| b. R1 | +00135 | |
| c. R2 | -00135 | |
| d. R3 | +00135 | |
| 6.2.20.3.14 | Record CRT indications | |
| a. CG 2279 ROLL ATT ERROR - CDU DAC OUT | | +1.78±0.18 VRMS |
| b. CG 2219 PITCH ATT ERROR - CDU DAC OUT | | -1.78±0.18 VRMS |
| c. CG 2249 YAW ATT ERROR - CDU DAC OUT | | +1.78±0.18 VRMS |
| 6.2.20.3.15 | Start tape reader. | |
| 6.2.20.3.16 | When tape reader stops observe on CRT | |
| a. V06 | NO1 | Flashing |
| b. R1 | +00090 | |
| c. R2 | -00090 | |
| d. R3 | +00090 | |
| 6.2.20.3.17 | Record CRT indications | |
| a. CG 2279 ROLL ATT ERROR - CDU DAC OUT | | +1.19±0.12 VRMS |
| b. CG 2219 PITCH ATT ERROR - CDU DAC OUT | | -1.19±0.12 VRMS |
| c. CG 2249 YAW ATT ERROR - CDU DAC OUT | | +1.19±0.12 VRMS |

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| 6.2.20.3.18 | Start tape reader. | |
| 6.2.20.3.19 | When tape reader stops observe on CRT | |
| | a. V06 NO1 Flashing | |
| | b. R1 +00000 | |
| | c. R2 +00000 | |
| | d. R3 -00090 | |
| 6.2.20.3.20 | Record CRT indications | |
| | a. CG 2279 ROLL ATT ERROR - CDU DAC OUT | 0.00±0.06 VRMS |
| | b. CG 2219 PITCH ATT ERROR - CDU DAC OUT | 0.00±0.06 VRMS |
| | c. CG 2249 YAW ATT ERROR - CDU DAC OUT | -1.19±0.12 VRMS |
| 6.2.20.3.21 | Start tape reader. | |
| 6.2.20.3.22 | When tape reader stops observe on CRT | |
| | a. V06 NO1 Flashing | |
| | b. R1 -00090 | |
| | c. R2 +00090 | |
| | d. R3 -00135 | |
| 6.2.20.3.23 | Record CRT indications | |
| | a. CG 2279 ROLL ATT ERROR - CDU DAC OUT | -1.19±0.12 VRMS |
| | b. CG 2219 PITCH ATT ERROR - CDU DAC OUT | +1.19±0.12 VRMS |
| | c. CG 2249 YAW ATT ERROR - CDU DAC OUT | -1.79±0.18 VRMS |
| 6.2.20.3.24 | Start tape reader. | |
| 6.2.20.3.25 | When tape reader stops observe on CRT | |
| | a. V06 NO1 Flashing | |
| | b. R1 -00135 | |
| | c. R2 +00135 | |
| | d. R3 -00160 | |
| 6.2.20.3.26 | Record CRT indications | |
| | a. CG 2279 ROLL ATT ERROR - CDU DAC OUT | +1.78±0.18 VRMS |
| | b. CG 2219 PITCH ATT ERROR - CDU DAC OUT | +1.78±0.18 VRMS |
| | c. CG 2249 YAW ATT ERROR - CDU DAC OUT | -2.11±0.21 VRMS |
| 6.2.20.3.27 | Start tape reader. | |
| 6.2.20.3.28 | When tape reader stops observe on CRT | |
| | a. V06 NO1 Flashing | |
| | b. R1 -00160 | |
| | c. R2 +00160 | |
| | d. R3 -00384 | |

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- 6.2.20.3.29 Record CRT indications:
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -2.11±0.21 VRMS
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +2.11±0.21 VRMS
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT -5.06±0.50 VRMS
- 6.2.20.3.30 Start tape reader.
- 6.2.20.3.31 When tape reader stops observe on CRT
- a. V06 NO1 Flashing
 - b. R1 -00384
 - c. R2 +00384
 - d. R3 -00385
- 6.2.20.3.32 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -5.06±0.50 VRMS
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +5.06±0.50 VRMS
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT -5.06±0.50 VRMS
- 6.2.20.3.33 Start tape reader.
- 6.2.20.3.34 When tape reader stops observe on CRT
- a. V06 NO1 Flashing
 - b. R1 -00385
 - c. R2 +00385
 - d. R3 +00000
- 6.2.20.3.35 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -5.06±0.50 VRMS
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +5.06±0.50 VRMS
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT 0.00±0.06 VRMS
- 6.2.20.4 TVC Test
- 6.2.20.4.1 The G/N Autopilot Control and SPS Ready discretes shall be applied to the G/N Interface.
- 6.2.20.4.2 Set the OPTICS MODE selector on the Indicator Control Panel to MAN. Set the OPTICS ZERO switch to OFF.
- 6.2.20.4.3 Start tape recorder.
- 6.2.20.4.4 When tape reader stops observe on CRT
- a. V01 N10 Flashing
 - b. R1 X7373
 - c. R3 00030

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| 6.2.20.4.5 | Start tape reader. | |
| 6.2.20.4.6 | When tape reader stops observe on CRT | |
| | a. V01 Noun 10 Flashing | |
| | b. R1 37777 | |
| | c. R3 00031 | |
| 6.2.20.4.7 | Start tape reader. | |
| 6.2.20.4.8 | When tape reader stops observe on CRT | |
| | a. V06 NO2 Flashing | |
| | b. R1 +00385 | |
| | c. R2 -00385 | |
| | d. R3 +00003 | |
| 6.2.20.4.9 | Record CRT indications | |
| | a. CG 3722 TRUNNION CDU DAC OUTPUT +10.12±1.00 VRMS | |
| | b. CG 3721 SHAFT CDU DAC OUTPUT -10.12±1.00 VRMS | |
| 6.2.20.4.10 | Start tape reader. | |
| 6.2.20.4.11 | When tape reader stops observe on CRT | |
| | a. V06 NO2 Flashing | |
| | b. R1 +00384 | |
| | c. R2 -00384 | |
| | d. R3 +00003 | |
| | e. NO ATT OFF | |
| 6.2.20.4.12 | Record CRT indications | |
| | a. CG 3722 TRUNNION CDU DAC OUTPUT +10.12±1.00 VRMS | |
| | b. CG 3721 SHAFT CDU DAC OUTPUT -10.12±1.00 VRMS | |
| 6.2.20.4.13 | Start tape reader. | |
| 6.2.20.4.14 | When tape reader starts observe on CRT | |
| | a. V06 NO2 Flashing | |
| | b. R1 +00160 | |
| | c. R2 -00160 | |
| | d. R3 +00003 | |

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- 6.2.20.4.15 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +4.22±0.42 VRMS
 - b. CG 3721 SHAFT CDU DAC OUTPUT -4.22±0.42 VRMS
- 6.2.20.4.16 Start tape reader.
- 6.2.20.4.17 When tape reader stops observe on CRT
- a. V06 NO2 Flashing
 - b. R1 +00135
 - c. R2 -00135
 - d. R3 +00003
- 6.2.20.4.18 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +3.56±0.36 VRMS
 - b. CG 3721 SHAFT CDU DAC OUTPUT -3.56±0.36 VRMS
- 6.2.20.4.19 Start tape reader.
- 6.2.20.4.20 When tape reader stops observe on CRT:
- a. V06 NO2 Flashing
 - b. R1 +00090
 - c. R2 -00090
 - d. R3 +00003
- 6.2.20.4.21 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +2.38±0.24 VRMS
 - b. CG 3721 SHAFT CDU DAC OUTPUT -2.38±0.24 VRMS
- 6.2.20.4.22 Set the OPTICS SPEED Switch on the Indicator Control Panel to HI.
- 6.2.20.4.23 Start tape reader.
- 6.2.20.3.24 When tape reader stops observe on CRT
- a. V06 NO2 Flashing
 - b. R1 +00000
 - c. R2 +00000
 - d. R3 +00003
- 6.2.20.4.25 While holding the Optics Hand Controller up and left (45°) no longer than 10 seconds, record CRT indications.
- a. CG 3722 TRUNNION CDU DAC OUTPUT 0.00±0.12 VRMS
 - b. CG 3721 SHAFT CDU DAC OUTPUT 0.00±0.12 VRMS

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- 6.2.20.4.26 Start tape reader.
- 6.2.20.4.27 When tape reader stops observe on CRT
- a. V06 NO2 Flashing
 - b. R1 -00090
 - c. R2 +00090
 - d. R3 +00003
- 6.2.20.4.28 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -2.38±0.24 VRMS
 - b. CG 3721 SHAFT CDU DAC OUTPUT +2.38±0.24 VRMS
- 6.2.20.4.29 Set the OPTICS ZERO Switch on the Indicator Control Panel to ZERO for 30 seconds, then return to OFF
- 6.2.20.4.30 Start tape reader.
- 6.2.20.4.31 When tape reader stops observe on CRT
- a. V06 NO2 Flashing
 - b. R1 -00135
 - c. R2 +00135
 - d. R3 +00003
- 6.2.20.4.32 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -3.56±0.36 VRMS
 - b. CG 3721 SHAFT CDU DAC OUTPUT +3.56±0.36 VRMS
- 6.2.20.4.33 Start tape reader.
- 6.2.20.4.34 When tape reader stops observe on CRT
- a. V06 NO2 Flashing
 - b. R1 -00160
 - c. R2 +00160
 - d. R3 +00003
- 6.2.20.4.35 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -4.22±0.42 VRMS
 - b. CG 3721 SHAFT CDU DAC OUTPUT +4.22±0.42 VRMS
- 6.2.20.4.36 Start tape reader.

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- 6.2.20.4.37 When tape reader stops observe on CRT
- a. V06 NO2 Flashing
 - b. R1 -00384
 - c. R2 +00384
- 6.2.20.4.38 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -10.12±1.00 VRMS
 - b. CG 3721 SHAFT CDU DAC OUTPUT +10.12±1.00 VRMS
- 6.2.20.4.39 Start tape reader.
- 6.2.20.4.40 When tape reader stops observe on CRT
- a. V06 NO2 Flashing
 - b. R1 -00385
 - c. R2 +00385
 - d. R3 +00003
- 6.2.20.4.41 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -10.12±1.00 VRMS
 - b. CG 3721 SHAFT CDU DAC OUTPUT +10.12±1.00 VRMS
- 6.2.20.4.42 Insert in K-148
- a. V36 ENTER
 - b. V41 N20 ENTER
 - c. +00000 ENTER
 - d. +00000 ENTER
 - e. +00000 ENTER

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ADDENDUM III

SCOPE: The following changes are required to make ND1002348 applicable as a G&N System Technical support document for CSM 101.

- Change 1. Add paragraph 6.1.1.7 as follows:
- 6.1.1.7 Data from the on board tape recorder shall be made available and the following signals verified:
- a. IG TORQUE MOTOR CURRENT (CG 2120) shall be less than 0.125 amp max.
 - b. OG TORQUE MOTOR CURRENT (CG 2180) shall be less than 0.125 amp max.
 - c. MG TORQUE MOTOR CURRENT (CG 2150) shall be less than 0.125 amp max.
- Change 2 Paragraph 6.2.1.3.8.5 change the last sentence to read as follows:
- On the Event Recorder verify that the IMU HTR Current discrete (CG 2302 FQ) is ON and that the IMU Blower Current discrete (CG 2303 FQ) is OFF over the last 2 hour period (occasionally discrete may cycle).
- Change 3 Add paragraph 6.2.4.6.1 as follows:
- 6.2.4.6.1 On the analog recorder verify that CG 1211 FQ, OPTICS 28V 800 cps 1% 0 deg. RMS voltage is 28.0±0.6 VAC.
- Change 4 Add paragraph 6.2.20.2.5.1 and 6.2.20.2.32.1 as follows:
- 6.2.20.2.5.1 Verify on the analog recorder the following signals:
- a. CG 2279 FQ ROLL ATT ERROR - CDU DAC OUT +5.06±0.50 VRMS
 - b. CG 2219 FQ PITCH ATT ERROR - CDU DAC OUT -5.06±0.50 VRMS
 - c. CG 2249 FQ YAW ATT ERROR - CDU DAC OUT +5.06±0.50 VRMS
- 6.2.20.2.32.1 Verify on the analog recorder the following signals:
- a. CG 2279 FQ ROLL ATT ERROR - CDU DAC OUT -5.06±0.50 VRMS
 - b. CG 2219 FQ PITCH ATT ERROR - CDU DAC OUT +5.06±0.50 VRMS
 - c. CG 2249 FQ YAW ATT ERROR - CDU DAC OUT -5.06±0.50 VRMS

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- Change 5 Add new paragraph 6.1.1.8 as follows:
- From the on board tape recorder verify the presence of the following signals:
- a. VIB NB ROLL (CG 6001)
 - b. VIB NB PITCH (CG 6002)
 - c. VIB NB YAW (CG 6003)
- Change 6 Paragraph 6.2.1.3.8.5 add to the first sentence the following:
- "...PIPA TEMP (CG 2300) and IRIG TEMP (CG 2301) on the CRT."
- Add Paragraph 6.2.3.1.13 as follows:
- 6.2.3.1.13 "30 minutes after the application of IMU OPERATE power record IRIG TEMP (CG 2301) displayed on the CRT"
- Paragraph 6.2.3.1.14, add to the first sentence the following:
- "...PIPA TEMP (CG 2300) and IRIG TEMP (CG 2301) every..."
- Paragraph 6.2.3.1.15 change to read as follows:
- "When 2 hours have elapsed since the application of IMU OPERATE power record PIPA TEMP and IRIG TEMP. PIPA TEMP shall be 130.5° ±1.5° F. IRIG TEMP shall be 135° ±2.5° F. PIPA TEMP shall be within 0.5° F of that recorded in 6.2.3.1.12 and 6.2.1.3.8.4. IRIG TEMP shall be within 0.5° F of that recorded in 6.2.3.1.13".
- Paragraph 6.2.5.2.16, add the following to Table VI:
- "14. CG 2301. IRIG TEMPERATURE"
- Add Paragraph 6.2.1.3.8.4.1 as follows:
- 6.2.1.3.8.4.1 The IRIG TEMP on the CRT shall be monitored at 15 min, 1 hour, and 2 hours after 6.2.1.3.8.2 is executed to insure that the IRIG TEMP (CG 2301) is within +3.0 degrees of the PIPA Temperature.
- Change 7 Paragraph 6.1.1.6, add item "f" as follows:
- "f" The TRACKER switch on G&N Indicator Control Panel shall be set to OFF.

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- Change 8 Replace paragraph 6.2.3.1.2 with the following:
- 6.2.3.1.2 Switches and selectors on the G&N Indicator control panel shall be set as follows:
- a. OPTICS MODE to MANUAL
 - b. CONTROLLER COUPLING to DIRECT
 - c. CONTROLLER SPEED to MED
 - d. TELESCOPE TRUNNION to SLAVE to SXT
 - e. RETICLE BRIGHTNESS to minimum brightness position.
- Change 9 Replace paragraph 6.2.3.2.3.2 with the following:
- 6.2.3.2.3.2 Set the OPTICS MODE on the G&N Indicator Control Panel to ZERO. Wait 15 seconds.
- Change 10 Replace paragraph 6.2.5.1.2 with the following:
- 6.2.5.1.2 Set the following switches on the G&N Indicator Control Panel to the positions designated.
- a. OPTICS MODE to ZERO
 - b. CONTROLLER MODF to DIRECT
 - c. CONTROLLER SPEED to LO
 - d. TELESCOPE TRUNNION to SLAVE TO SXT
 - e. RETICLE BRIGHTNESS to minimum brightness position
- Change 11 Replace paragraph 6.2.5.2.1 with the following:
- 6.2.5.2.1 Set or verify the following G&N Indicator Control Panel switches to the position indicated.
- a. CONDITION LAMPS to ON
 - b. OPTICS MODE to ZERO
 - c. CONTROLLER COUPLING to DIRECT
 - d. CONTROLLER SPEED to LO
 - e. TELESCOPE TRUNNION to SLAVE to SXT
 - f. RETICLE BRIGHTNESS to minimum brightness position.
- Change 12 Replace paragraph 6.2.9.23 with the following:
- 6.2.9.23 Set the OPTICS MODE switch on the Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to CMC.
- Change 13 Replace sections 6.2.10 and 6.2.11 with the following:
- 6.2.10 Zero Optics Test.
- 6.2.10.1 Set the G&N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.

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NOTE: Proceed with this test if 6.2.3 Operate Power on Test has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 Turn On Procedure before proceeding.

INITIALIZATION

- 6.2.10.2 Insure that the following switches on the G&N Indicator Control Panel are set as follows:
- TELESCOPE TRUNNION to SLAVE to SXT
 - CONTROLLER COUPLING to DIRECT
 - CONTROLLER SPEED to HI
 - OPTICS MODE to MAN
- 6.2.10.3 Monitor the Optics CDU's by entering VERB 16 NOUN 91 into K-148. Press the ENTER pushbutton.
- 6.2.10.4 Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Verify the Optics have zeroed properly by observing the following on R1 and R2 of the CRT.
- $R1 = +0.00^\circ \pm 0.02^\circ, -0.03^\circ$ (Shaft Angle)
 - $R2 = +0.000^\circ \pm 0.006^\circ, -0.007^\circ$ (Trunnion Los Angle)
- 6.2.10.4.1 Enter the following:
- VERB 01 NOUN 10 ENTER
 00033 ENTER
 Verify R1 = XXX6X
- 6.2.10.4.2 Set the OPTICS MODE switch to CMC. Enter the following:
- ENTER
 00033, ENTER
 Verify R1 = XXX5X
- #### OPTICS TIME TO ZERO TEST
- 6.2.10.5 Set up the Analog Recorder to monitor the following measurements.
- CG 3140 SXT Shaft Tach Output
 - CG 3150 SXT Trunnion Tach Output
 - CG 3160 SCT Shaft Tach Output
 - CG 3170 SCT Trunnion Tach Output
 - CG 3117 SXT Shaft Servo Error in phase

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- f. CG 3118 SXT Trunnion Servo Error in phase
- g. CG 3145 SXT Shaft MTR control winding
- h. CG 3155 SXT Trunnion MTR control winding

6.2.10.6 Push the Optics Hand Controller to the right, driving the SXT Shaft until R1 on the CRT indicates $+180 \pm 1^\circ$. Push the Optics Hand Controller up, driving the SXT Trunnion until R2 on the CRT indicates $+75 \pm 1^\circ$.

6.2.10.7 Start the Analog Recorders and set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO.

6.2.10.8 Monitor the Analog Recorders until all signals return to null. Stop the Analog Recorders. The elapsed time between the initial and final SXT Shaft and Trunnion Tach output nulls shall be less than 15 seconds. The peak magnitude of the SXT Shaft (CG 3140) and Trunnion (CG 3150) Tach Outputs shall be $-3.3 \pm 1.3V$ rms. The peak magnitude of the SCT Shaft Tach Output (CG 3160) shall be $+3.3 \pm 1.3V$ rms. The peak magnitude of the SCT Trunnion Tach Output (CG 3170) shall be $0.85 \pm 0.34V$ rms. The SXT SHAFT (CG 3117) and TRUNNION (CG 3118) Servo Error In Phase measurements shall each have a maximum magnitude of 2 VRMS. The peak magnitude of the SXT SHAFT (CG 3145) and TRUNNION (CG 3155) MTR Control Winding measurements shall be 0.85 ± 0.35 VRMS.

6.2.10.9 Record R1 and R2 on the CRT. The data displayed shall be as follows:

- a. R1 = $000.00 + 000.02$, -0.03
- b. R2 = $00.000 + 00.006$, -0.007

6.2.10.10 Record the Telescope Panel Angle Counter indications. The Shaft Angle shall be 0.0 ± 0.11 degrees. The Trunnion Angle shall be 0.0 ± 0.22 degrees.

6.2.10.11 Set the OPTICS MODE switch on the G&N Indicator Control Panel to MAN. Set the G/N Power Optics switch on the LEB Lighting Control Panel to OFF.

OPTICS BACKUP MODE TEST

6.2.10.12 Insert the Inflight Tool (V36601405) into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eye-piece while turning the tool until the TPAC reads $+5^\circ$. Remove the tool from the trunnion tool input.

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6.2.10.13 Insert the Inflight Tool (V36601405) into the Shaft Tool Input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to -3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool.

6.2.10.14 Insert the Inflight Tool (V36601405) into the Trunnion Tool input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool.

6.2.11 OPTICS Coordinate Transformation Control Test.

6.2.11.1 Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.

NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding.

INITIALIZATION

6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.

- a. TELESCOPE TRUNNION to SLAVE to SXT
- b. CONTROLLER COUPLING to DIRECT
- c. CONTROLLER SPEED to HI
- d. OPTICS MODE to MAN

6.2.11.9 Quickly displace the OPTICS CONTROL STICK 45±10 degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at 45±10 deg. When Target leaves the SCT upper right field of view press MARK pushbutton. Press the KEY REL pushbutton and immediately record the shaft angle as displayed on R1 of the DSKY. The recorded shaft angle shall be +225±10.00 degrees.

6.2.11.10 Stop the analog recorder and measure the elapsed time between the initial and the final signal null conditions for the trunnion measurement. The elapsed time shall be from 19 to 32 seconds.

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CSC AMPLIFIER SHAFT AND TRUNNION DRIVE TEST

- 6.2.11.11 Set the CONTROLLER COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the optics until R1 = +225.00 and R2 = +10.000. Set the CONTROLLER COUPLING switch to RSLV.
- 6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.
- 6.2.11.13 Set the CONTROLLER COUPLING switch on the G&N Panel to DIRECT. Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN.
- 6.2.11.13.1 Perform the following to remove the "MARKING SYSTEM IN USE" Bit of EXTVBACT registers.
- 6.2.11.13.1.1 Enter the following into the K-Start:
- a. VERB 01 NOUN 01, ENTER
 - b. 00766 ENTER
 - Record R1 = XXXXY
- 6.2.11.13.1.2 Enter the following into the K-Start:
- a. VERB 21 NOUN 01 ENTER
 - b. 00766, ENTER
 - c. XXXXY', ENTER where Y' is determined from Table II and XXXX is that recorded in 6.2.11.13.1.1.

TABLE II

| Y (From 6.2.11.13.1.1) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|------------------------|---|---|---|---|---|---|---|---|
| Y' | 0 | 1 | 0 | 1 | 4 | 5 | 4 | 5 |

- 6.2.11.3 Enter the following into the K-Start to monitor the OPTICS CDU's.
- VERB 16 NOUN 91 press ENTER
- 6.2.11.3.1 Perform the following to set the "MARKING SYSTEM IN USE". Bit of EXTVBACT registers.

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6.2.11.3.1.1 Enter the following into the K-Start:

- VERB 01 NOUN 01, ENTER
 - 00766, ENTER
- Record R1 = XXXXY

6.2.11.3.1.2 Enter the following into the K-Start:

- VERB 21 NOUN 01, ENTER
- 00766, ENTER
- XXXXY', ENTER where Y' is determined from Table I and XXXX is that recorded in 6.2.11.3.1.1.

TABLE I

| Y (from 6.2.11.3.1.1) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------------------|---|---|---|---|---|---|---|---|
| Y' | 2 | 3 | 2 | 3 | 6 | 7 | 6 | 7 |

6.2.11.4 Set the OPTICS MODE switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS MODE switch to MAN.

6.2.11.5 Set up the analog recorders to monitor the following measurements:

- CG 3170 SCT Trunnion Tachometer Output

RESOLVED MODE PHASING AND IMAGE RATE TEST

6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until R1 = +225.00 and R2 = +10.000 on the CRT and the DSKY's.

6.2.11.7 Set the CONTROLLER COUPLING switch on the G&N Panel to RSLV and the controller speed switch to MED.

6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.

Change 14 Replace section 6.2.12 with the following:

6.2.12 OPTICS FUNCTIONAL TEST

6.2.12.1 Deleted.

6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:

- +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8±3 VDC. Record the indication on the CRT.
- CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.
- CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT.

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- 6.2.12.3 Deleted.
- 6.2.12.4 Insure that the Optics Control switches on the G&N Indicator Control Panel are set as follows:
- OPTICS MODE to MAN
 - CONTROLLER SPEED to LO
 - CONTROLLER COUPLING to DIRECT
 - TELESCOPE TRUNNION to SLAVE to SXT
- 6.2.12.5 Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN.
- 6.2.12.6 Resolution Checks
- 6.2.12.6.1 SXT Resolution Check - MSO only.
- 6.2.12.6.1.1 Sight through the SXT eyepiece. Using the OPTICS CONTROL STICK, adjust the SXT to obtain the best reflected field of view of the 5-inch autocollimator reticle engravings at the center of view.
- 6.2.12.6.1.2 Note that the autocollimator reticle contains a series of lines of different thickness and width. Each set of lines is marked with a number (20, 15, 10, 7, 5, 3) which indicates the angle subtended by one line and one space. View each set of lines to determine the lowest numbered set in which resolution between lines (ability to distinguish separate distinct lines within a set) can be made. Record the number associated with that set of lines. The SXT resolution shall be at least 10 arc seconds at the center of the field of view.
- 6.2.12.6.2 SCT Resolution Check
- 6.2.12.6.2.1 Sight through the SCT EYEPIECE. Using the OPTICS CONTROL STICK adjust the SCT to obtain the best view of the SCT RESOLUTION CHART held in the Optics line of sight.
- 6.2.12.6.2.2 Note the chart contains sets of lines. View each set of lines to determine the lowest numbered set in which the resolution between lines (ability to distinguish separate lines within a set) can be made. The SCT shall have a resolution of at least 3 arc minutes at the center of the field of view.
- 6.2.12.7 Slave Telescope Mode Checks
- 6.2.12.7.1 Verify/perform OPTICS POWER ON TEST per paragraph 6.2.3.2.
- 6.2.12.7.2 Set/Verify following switches on G&N INDICATOR CONTROL PANEL:
- TELESCOPE TRUNNION - SLAVE to SXT
 - CONTROLLER COUPLING - DIRECT
 - CONTROLLER SPEED - HI

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- 6.2.12.7.3 Monitor OCDU's by entering VERB 16 NOUN 91 into K-148. Press ENTER.
- 6.2.12.7.4 Set OPTICS MODE to MAN.
- 6.2.12.7.5 Using the Optics Hand Controller drive the optics until:
R1 = +010.00±001.00 (SHAFT)
R2 = +10.000±01.000 (TRUNNION)
- 6.2.12.7.6 Verify on the CRT and Optics Panel:
SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.7 Set the TELESCOPE TRUNNION on the G&N INDICATOR CONTROL PANEL to 0°.
- 6.2.12.7.8 Verify:
SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = 0.0° ±0.22 DEG
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.9 Set the TELESCOPE TRUNNION on the G&N INDICATOR CONTROL PANEL to OFFSET 25°.
- 6.2.12.7.10 Verify on CRT and Optics Panel:
SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = 25° ±0.22 DEG
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.11 On the G&N INDICATOR CONTROL PANEL set the TELESCOPE TRUNNION to SLAVE to SXT.
- 6.2.12.7.12 Verify on CRT and Optics Panel:
SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.13 On the GN INDICATOR CONTROL PANEL set the OPTICS MODE to ZERO. Wait 15 sec.
- 6.2.12.7.14 Verify on CRT and OPTICS PANEL:
R1 = 000.00+000.02, -000.03
R2 = 00.000+00.006, -00.007
SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.15 If Optics testing will not be continued, set the G&N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF
- 6.2.12.8 SXT Parallelism Tests

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6.2.12.8.1 Remove the plug from the base of the SXT eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light.

NOTE: If needed to reduce external light, place a photographers hood over the optics head.

6.2.12.8.2 SXT Auto Collimator Parallelism Test -MSO only

6.2.12.8.2.1 Using the OPTICS CONTROL STICK drive the SXT StLOS Trunnion to $+15.00^\circ \pm 2^\circ$ as indicated in R2 of the DSKY. Maintain a Shaft CDU angle of 000.00 ± 0.10 degrees.

6.2.12.8.2.2 Sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to superimpose the SXT LLOS horizontal reticle image upon the autocollimator horizontal filar. Record the autocollimator reading.

6.2.12.8.2.3 Repeat 6.2.12.8.2.2 twice. Calculate and record the average of the three autocollimator readings.

6.2.12.8.2.4 Set the OPTICS MODE switch to ZERO. After 15 seconds return the OPTICS MODE switch to MAN.

6.2.12.8.2.5 Again sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to bring the SXT StLOS horizontal reticle and autocollimator horizontal filar images to coincide. Record the autocollimator reading.

6.2.12.8.2.6 Repeat 6.2.12.8.2.5 twice. Calculate and record the average of the three autocollimator readings. The average value obtained here shall not differ from that obtained in 6.2.12.8.2.3 by more than 10 arc seconds.

6.2.12.8.3 SXT Trun 90° Positional Accuracy Test

6.2.12.8.3.1 Obtain Portable Light Assembly and Adapter Assembly. Remove the plug from base of SXT Eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the Light.

6.2.12.8.3.2 Using the OPTICS CONTROL STICK drive the SXT Trunnion angle to $85.000^\circ \pm 5^\circ$ as indicated on R2 of the DSKY. Set the CONTROLLER SPEED to LO and drive the SXT Trunnion to $+90.000^\circ \pm 0.100^\circ$ as indicated on R2 of the DSKY. Insure that the SXT Shaft angle remains at 000.00 ± 0.10 degrees as indicated by R1 on the DSKY.

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- 6.2.12.8.3.3 Sight through the SXT. Two reticle patterns shall be visible. Use the OPTICS CONTROL STICK to adjust the SXT Trunnion angle until the two horizontal reticle lines are coincident. Record the Trunnion CDU angle displayed on R2. The Trunnion CDU angle shall be 90.000 ± 0.010 degrees.
- 6.2.12.8.3.4 Remove the Portable Light Assembly and Adapter Assembly from the base of the SXT eyepiece. Replace the SXT eyepiece plug.
- NOTE: If Optics testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.9 SXT, CMC FUNCTION CHECK
- 6.2.12.9.1 Set the OPTICS MODE switch to ZERO. After 15 seconds, return the switch to MAN.
- 6.2.12.9.2 Sight through the SXT. Using the Control Stick align the SXT StLOS with Optical Target No. 1.
- 6.2.12.9.3 When aligned record the value of Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.4 Sight through the SXT. Using the Control Stick align the SXT St. LOS with Optical Target No. 2.
- 6.2.12.9.5 When aligned, record the value of Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.6 Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. After 15 seconds set the switch to MAN, then CMC.
- 6.2.12.9.7 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.3 into the DSKY and press ENTER. Enter the value for Trunnion from 6.2.12.9.3 into the DSKY and press ENTER.
- 6.2.12.9.8 Sight through the SXT. The StLOS should be approximately centered on the Optical Target No. 1. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.3 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.9 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton. Enter the value for Trunnion from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton.

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- 6.2.12.9.10 Sight through the SXT. The StLOS should be approximately centered on the Optical Target No. 2. Press the MARK pushbutton and record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.11 Set the OPTICS MODE switch to ZERO. Wait 15 seconds.
- 6.2.12.9.12 If OPTICS testing will not continue, set the G&N Power Optics switch on the LEB Lighting Panel to OFF.
- Change 15 Replace section 6.2.13 with the following:
- 6.2.13 Optics Slew Rate Test.
- 6.2.13.1 Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following signals on the CRT.
- a. +28 VDC OPTICS OPERATE BUS (CG 1530) is +29.0±3.0 VDC.
 - b. OPTX 28V 800 cps 1% 0° ph not flashing on the CRT.
 - c. OPTX 28V 800 cps 5% -90° not flashing on the CRT.
- 6.2.13.1.1 Verify and/or set the following switches on the G&N Indicator Control Panel to the positions indicated.
- a. TELESCOPE TRUNNION to SLAVE to SXT
 - b. CONTROLLER COUPLING to DIRECT
 - c. CONTROLLER SPEED to HI
 - d. OPTICS MODE to MAN
 - e. TRACKER to OFF
- 6.2.13.2 Monitor the OCDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton. Insure RECORD DSKY and RECORD DOWNLINK on R-145 are on.
- 6.2.13.3 TRUNNION SLEW RATE - HIGH SPEED
Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS MODE switch on the G&N Indicator Panel to MAN.
- 6.2.13.3.1 During the Trunnion Slew Rate Test monitor and verify the following signals:
- | Signal | Requirement |
|--|-------------|
| a. SXT TRUNNION TACH O/P (CG 3150), FQ 3.3±1.3 VRMS | |
| b. SCT TRUNNION TACH O/P (CG 3170), FQ -0.85±0.35 VRMS | |
- NOTE: Read and understand 6.2.13.4 before proceeding. Do not hold Control Stick at upper limit more than 10 seconds or exceed a trunnion angle of 85°.

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6.2.13.4 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 7 seconds release the control stick.

6.2.13.5 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the slew rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Trunnion slew rate shall be 10.0 ± 2.0 deg/sec.

SHAFT SLEW RATE - HI SPEED

6.2.13.6 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.

6.2.13.6.1 During the Shaft Slew Rate Test monitor and verify the following signals:

| Signal | Requirement |
|--------|-------------|
|--------|-------------|

- | | |
|-------------------------------------|---------------------|
| a. SXT SHAFT TACH O/P (CG 3140), FQ | 3.3 ± 1.3 VRMS |
| b. SCT SHAFT TACH O/P (CG 3160), FQ | -3.3 ± 1.3 VRMS |

NOTE: Read and understand step 6.2.13.7 before proceeding.
Do not hold Control Stick at right limit for more than 10 seconds or exceed a shaft angle of 250° .

6.2.13.7 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 7 seconds release the control stick.

6.2.13.8 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the slew rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Shaft slew rate shall be 19.5 ± 3.9 deg/sec.

TRUNNION SLEW RATE - MED SPEED.

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6.2.13.9 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the OPTICS CONTROLLER SPEED switch to MED.

NOTE: Read and understand 6.2.13.10 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.

6.2.13.10 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.

6.2.13.11 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU registers (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Trunnion slew rate shall be 1.0 ± 0.2 deg/sec.

SHAFT SLEW RATE - MED SPEED

6.2.13.12 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set OPTICS MODE switch to MAN.

NOTE: Read and understand 6.2.13.13 before proceeding. Do not hold control stick at the right limit for more than 20 seconds.

6.2.13.13 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.

6.2.13.14 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Shaft slew rate shall be 2.0 ± 0.4 deg/sec.

TRUNNION SLEW RATE - LO SPEED

6.2.13.15 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the CONTROLLER SPEED switch to LO.

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6.2.13.15.1 During the Trunnion Slew Rate Test monitor and verify the following signals:

| | |
|---------------------------------------|-----------------------|
| Signal | Requirement |
| a. TRUNNION CDU FINE ERROR (CG 3001), | FQ \pm .07 VRMS MAX |

NOTE: Read and understand 6.2.13.16 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.

6.2.13.16 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.

6.2.13.17 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the slew rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Trunnion Slew Rate shall be 0.10 ± 0.02 deg/sec.

SHAFT SLEW RATE - LO SPEED

6.2.13.18 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.

6.2.13.18.1 During the Shaft Slew Rate test monitor and verify the following signal:

| | |
|--------------------------------------|--------------------|
| Signal | Requirement |
| a. SHAFT CDU FINE ERROR (CG 3021) FQ | \pm .07 VRMS MAX |

NOTE: Read and understand 6.2.13.19 before proceeding. Do not hold control stick at right limit for more than 20 seconds.

6.2.13.19 Record time. Push and hold the Optics Control stick to its right limit. After approximately 12 seconds release the control stick.

6.2.13.20 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the slew rate test was being performed.

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6.2.13.20 Calculate the rate by dividing the Δ CDU angle by the elapsed time.
(continued) The Shaft Slew Rate shall be 0.20 ± 0.04 deg/sec.

OPTICS HAND CONTROLLER DRIFT RATE CHECK - LO SPEED

6.2.13.21 Set the OPTICS MODE switch to zero. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Record time. Wait 60 seconds.

6.2.13.22 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion and Shaft CDU registers (addresses 35 and 36 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 60 second period during which the drift rate test was being performed.

Calculate the drift rates by dividing the Δ CDU angle by the elapsed time.

The Trunnion drift rate shall be less than .0167 deg/sec.

The Shaft drift rate shall be less than .0333 deg/sec.

6.2.13.23 If OPTICS testing will not continue, set the G/N Power-Optics switch on the LEB Lighting Control Panel to OFF.

Change 16 Replace Paragraph 6.2.17.5 with the following:

6.2.17.5 On the G&N Indicator Control Panel set the following switches to the position indicated.

- a. TELESCOPE TRUNNION to SLAVE to SXT
- b. CONTROLLER COUPLING to DIRECT
- c. CONTROLLER SPEED to LO
- d. OPTICS MODE to ZERO.

Change 17 Replace paragraph 6.2.17.20 with the following:

6.2.17.20 Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN. Enter VERB 33, ENTER into the DSKY.

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Change 18 Replace paragraphs 6.2.18.8.2, 6.2.18.8.11, 6.2.18.8.12 and 6.2.18.8.14 with the following:

6.2.18.8.2 Enter the following into the DSKY:

| | | |
|---------|---------|-------------------------|
| VERB 21 | NOUN 03 | ENTER |
| 02553 | | ENTER |
| +XXX.XX | ±000.01 | ENTER (Target No. 1AZ) |
| | | ENTER |
| 02554 | | ENTER |
| +00.000 | | ENTER (Target No. 1 EL) |
| | | ENTER |
| 02555 | | ENTER |
| +XXX.XX | ±000.01 | ENTER (Target No. 2 AZ) |
| | | ENTER |
| 02556 | | ENTER |
| +00.000 | | ENTER (Target No. 2 EL) |

On the G&N Indicator Control Panel, set the Optics Mode Switch to MAN and the Controller Speed to HI. Drive the StLOS to the approximate position of Target No. 1. Set the Controller Speed switch to LO.

6.2.18.8.11 Set the CONTROLLER SPEED switch to HI. Using the Optics Hand Controller, drive the SXT StLOS to the approximate position of Target 2.

6.2.18.8.12 Set the CONTROLLER SPEED switch to LO. Using the Optics Hand Controller, align the SXT StLOS to Target 2 and press the MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied, press the MARK REJECT pushbutton and repeat this step.

6.2.18.8.14 Enter VERB 34, ENTER into the DSKY. Observe the PROGRAM display change to 02. Set the Optics Mode Switch on the G&N Indicator Control Panel to ZERO.

Change 19 Replace paragraphs 6.2.20.3.2, 6.2.20.3.22, and 6.2.20.3.29 and replace with the following:

6.2.20.3.2 Set the OPTICS MODE selector on the Indicator Control panel to MAN.

6.2.20.3.22 Set the OPTICS CONTROLLER SPEED switch on the Indicator Control Panel to HI.

6.2.20.3.29 Set the OPTICS MODE Switch on the Indicator Control panel to ZERO for 30 seconds then return to MAN.

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POST INSTALLATION CHECKOUT PROCESS
 SPECIFICATION FOR THE APOLLO GUIDANCE &
 NAVIGATION SYSTEM BLOCK II-KSC

Record of Revisions

| Date | Revision Letter | TDR No. | Pages Revised | Approval |
|---------|-----------------|---------|--|----------|
| 5/11/67 | A | 33750 | 10-12, 15, 24, 35-46, 51-53, 58-67, 73-78, 81, 82, 84-86, 91, 95-97, 99-102, 105-119. Was 119 pages, now 120. <i>gk/ac</i> | EA |
| 9/29/67 | B | 34782 | 2-128; Specification was 128 pages, now 129 pages. <i>gk/ac</i> | EA |
| 1/16/68 | C | 35445 | Completely revised. Specification was 129 pages, now 174 pages. <i>gk/ac</i> | EA |
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| APPROVALS | NASA/MSC | <i>gk/ac</i> | <i>gk/ac</i> |
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| 5.2 | | |
| Standard Environmental Conditions | | |
| 5.2.1 | | |
| The G&N System when installed in the Command Module shall be tested in an environment in accordance with ICD MH01-1348-416. At no time shall the dust particle count exceed Level 3000,000 of Federal Standard 209 with no more than 2,000 particles per cubic foot larger than 5 microns; no more than 35 particles larger than 65 microns with no more than 3 of these 35 larger than 100 microns in existence. Dust covers shall be installed on the SXT and SCT per ICD MH01-01350-116 when optics are not under test. | | |
| 5.2.1.1 | | |
| For periods of G&N Testing with the optical heads and the eyepieces of the SCT and SXT of the C/M G&N uncovered, or with the eyepieces removed, the environment shall meet at least the Class 100,000 particle size and count. | | |
| 5.2.1.2 | | |
| With the optical heads covered and the eyepieces installed or covered on the optical components (SXT, SCT), the ambient environment shall meet the following conditions for particle size and count. No more than 1,400 particles 5.0 microns or larger per cubic foot. | | |
| 5.2.2 | | |
| The APOLLO G&N System shall interface with a qualified ECS distribution system which shall supply coolant fluid during STANDBY and OPERATE control modes with flow rates and inlet temperatures as specified in ICD MH01-01349-416. | | |
| 5.3 | | |
| Test Equipment Tolerances | | |
| 5.3.1 | | |
| Measurements and tolerances are specifications stated herein are basic G&N System performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. PSAAM and Signal Conditioner stability uncertainties are included in Appendix I, tables (see Appendix I) as well as ACE and SCA stability uncertainties shown in Table I-1. | | |

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6.2.1.3.8.3 Record the value of the following signals displayed on the CRT.

| | <u>Signal</u> | <u>Requirement</u> |
|----|---|--------------------|
| a. | CG 1331 28V 3200 CPS POWER SUPPLY FEEDBACK | 28.6±0.6 VRMS |
| b. | CG 1510 + 28 VDC STANDBY POWER | 28.5±3 VDC |

6.2.1.3.8.4 The PIPA TEMP on the CRT shall be monitored at 15 min., 1 hr. and 2 hrs. from execution of 6.2.1.4.1 to insure that the PIPA Temperature Control Loop circuitry is operating to maintain a temperature of $130.5 \pm 1.5^\circ\text{F}$ (CG2300).

6.2.1.3.8.5 At the termination of the 2-hour period, record the PIPA temperature (CG2300) on the CRT. On the event recorder verify that the IMU HEATER current discrete (CG2302) is ON and that the IMU BLOWER current discrete (CG2303) is OFF over the last two hour period (occasionally discrete may cycle).

6.2.1.3.8.6 With the eyepiece in the Eyepiece Storage Unit, check the eyepiece surface temperature at the quick disconnect flange using an IAN #8693 Temperature Potentiometer, or a similar type thermocouple probe meter. Record both the ambient and eyepiece surface temperatures and verify that the eyepiece surface temperature is at least 10°F above the ambient temperature.

6.2.1.3.9 Deleted. ~~SHC can be deleted, entering the following sequence into the Research:~~

2. TRAB 600 CENTER
3. 000000, 000000

6.2.1.3.10 Initiate CMC self-check by entering the following sequence into the K-start:

- a. VERB 21 NOUN 27, ENTER
- b. 77777, ENTER
- c. VERB 15 NOUN 01, ENTER
- d. 1366, ENTER

6.2.1.3.10.1 Monitor until R2 (SCOUNT +1) increments twice. If an error is detected, the PROGRAM ALARM lamp on the DSKY's shall light.

6.2.1.3.10.2 Terminate the monitor routine by entering the following into the DSKY.
VERB 34, ENTER

6.2.1.3.10.3 Enter the following into the K-start:

- a. VERB 21
- b. NOUN 27, press ENTER pushbutton
- c. 00000, press ENTER pushbutton

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- 6.2.2.6 Deleted
- 6.2.2.7 Parity Fail Test
- 6.2.2.7.1 Enter the following into the K-Start. Press the ENTER pushbutton after each entry.
- a. Deleted, ENTER
 - b. Deleted, ENTER
 - c. VERB 22 NOUN 02, ENTER
 - d. 02100 ENTER
 - e. 33777, ENTER
 - f. 04353, ENTER
 - g. VERB 25 NOUN 26, ENTER
 - h. 04000, ENTER
 - j. 01500 ENTER
 - k. 00004 ENTER
 - m. VERB 30, ENTER
- The RESTART lamps on the MDC & LEB DISKY's shall illuminate. The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.
- 6.2.2.7.2 Press the ERROR RESET pushbutton on the K-Start. The RESTART & PGNS caution lamps shall extinguish.
- 6.2.2.7.3 Enter VERB 36, into the K-START. Press the ENTER pushbutton.

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- 6.2.5.2.3 Energize the G&N COMPUTER MN A and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Press the STBY pushbutton on the DSKY for approximately 3 seconds. Verify +14 and +4 VDC AGC power supply outputs on CRT display. Voltages shall be $+14 \pm 0.4V$ (CG1020) and $+4 \pm 0.2$ (CG1030). On DSKY verify TEMP light is ON. On the G&N Indicator Control Panel verify PGNS light is ON.
- 6.2.5.2.4 Set the G&N POWER AC1 and AC2 breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in). Set the G&N POWER AC1-OFF-AC2 switch to AC1.
- 6.2.5.2.4.1 Set the G&N DSKY and Display Panel brightness to the minimum acceptable level by manipulation of LIGHTS - NUMERICS control on both Left Hand Circuit breaker panel and LEB Lighting Control panel.
- 6.2.5.2.5 Energize the G&N IMU HTR, MN A and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Insure that the CMC +28 VDC discrete lamp on the Event Module is illuminated (CG 1523). Verify TEMP light on DSKY is extinguished. Verify PGNS light on the G&N Indicator Control Panel is extinguished.
- 6.2.5.2.5.1 Set/Verify the following switches on the PSAAM.
- 6.2.5.2.6 Enter VERB 36 into K148. Press ENTER pushbutton. Press ERROR RESET pushbutton on K148. All computer alarms except the Gimbal Lock Indicator on the Main Display Console (MDC) and LEB AGC DSKY shall clear. Verify registers R1, R2, and R3 on the DSKY's are cleared. Verify PROG = 00.
- 6.2.5.2.7 Deleted. CMC crosscheck monitor by entering the following sequence into the K-Start:
- VERB 36, press ENTER
 - 0000, press ENTER
- 6.2.5.2.8 Initiate CMC self-check by entering the following sequence into the K-Start:
- VERB 21 NOUN 27, ENTER
 - 7777, ENTER
 - VERB 15 NOUN 01, ENTER
 - 1366, ENTER
- 6.2.5.2.8.1 Monitor DSKY until R3 (SCOUNT +2) increment twice. If an error is detected, the PROGRAM ALARM lamp on the DSKY's shall light.
- 6.2.5.2.8.2 Terminate the monitor routine by entering the following into the DSKY:
VERB 34, ENTER.

CODE IDENT. NO. 03953

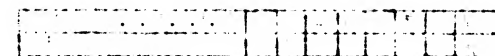
| NUMBER | REVISION LETTER | PAGE |
|--------------------------------|-----------------|--|
| OPTICS BACKUP MODE TEST | | |
| 6.2.10.12 | | Insert the Inflight Tool (V36601405) into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eyepiece while turning the tool until the TPAC reads +5°. Remove the tool from the Trunnion tool input. |
| 6.2.10.13 | | Insert the Inflight Tool (V36601405) into the Shaft Tool input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +5° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool. |
| 6.2.10.14 | | Insert the Inflight Tool (V36601405) into the Trunnion Tool input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool. |
| 6.2.11 | | OPTICS Coordinate Transformation Control Test. |
| 6.2.11.1 | | Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies. |
| | | NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding. |
| INITIALIZATION | | |
| 6.2.11.2 | | Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated. a. OPTICS TEL TRUN to SLAVE to EXT b. OPTICS COUPLING to DIRECT c. OPTICS SPEED to HI d. OPTICS MODE to MAN |
| 6.2.11.3 | | Deleted. Following into the K-100 to monitor the OPTICS G&N's. VERB 16 NOON 01, 40 00 0000 |
| 6.2.11.3.1 | | Deleted. the following to set the "ARMING" SYSTEM IN TEST MODE IN TEST MODE |
| 6.2.11.3.1.1 | | Deleted. Following into the K-100 to: a. VERB 01 NOON 01, 40 00 0000 b. VERB 02 NOON 01, 40 00 0000 Recover RI = SUCCESS |

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6.2.11.3.1.2 Deleted. *See 6.2.11.3.1.2 for details.*

See 6.2.11.3.1.2 for details.
See 6.2.11.3.1.2 for details.
See 6.2.11.3.1.2 for details.



6.2.11.4 Set the OPTICS ZERO switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS ZERO switch to OFF.

6.2.11.5 Set up the analog recorders to monitor the following measurements:

a. CG 3170 SCT Trunnion Tachometer Output

RESOLVED MODE PHASING AND IMAGE RATE TEST.

6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until R1 = +225.00 and R2 = +10.000 on the CRT and the DSKY's.

6.2.11.7 Set the OPTICS COUPLING switch on the G&N Panel to RSLV and the OPTICS Speed switch to MED.

6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.

6.2.11.9 Record time. Quickly displace the OPTICS CONTROL STICK 45±10 degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at 45±10 deg. When target leaves the SCT upper right field of view press MARK pushbutton. The PROG alarm light shall light.

6.2.11.10 From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 28 respectively) and the PROG alarm discrete for the period during which the OPTICS CONTROL STICK was being displaced above. The Shaft CDU angle shall be 225.00±10.00 degrees at the time the PROG alarm occurred. The elapsed time from time of OPTICS CONTROL STICK displacement to the time the PROG alarm discrete is obtained shall be 19 to 32 seconds.

6.2.11.11 Set the OPTICS COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the optics until R1 = +225.00 and R2 = +10.000. Set the OPTICS COUPLING switch to RSLV.

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| 6.2.12.7.13 | On the G&N INDICATOR CONTROL PANEL set the OPTICS ZERO to ZERO. Wait 15 sec. |
| 6.2.12.7.14 | Verify on CRT and OPTICS PANEL: R1 = 000.00+000.02, -000.03 R2 = 00.000+00.006, -00.007° SHAFT TPAC = R1 ±0.11 DEG TRUN TPAC = R2 ±0.22 DEG |
| 6.2.12.7.15 | If Optics testing will not be continued, set the G&N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF. |
| 6.2.12.8 | SXT Parallelism Tests |
| 6.2.12.8.1 | Remove the plug from the base of the SXT eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light. NOTE: If needed to reduce external light, place a photographers hood over the optics head. |
| 6.2.12.8.2 | SXT Auto Collimator Parallelism Test - MSO only. |
| 6.2.12.8.2.1 | Using the OPTICS CONTROL STICK drive the SXT StLOS Trunnion to +15.00° ±2° as indicated in R2 of the DSKY. Maintain a Shaft CDU angle of 000.00±0.10 degrees. |
| 6.2.12.8.2.2 | Sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to superimpose the SXT LLOS horizontal reticle image upon the autocollimator horizontal filar. Record the autocollimator reading. |
| 6.2.12.8.2.3 | Repeat 6.2.12.8.2.2 twice. Calculate and record the average of the three autocollimator readings. |
| 6.2.12.8.2.4 | Set the OPTICS ZERO switch to ZERO. After 15 seconds, turn the OPTICS ZERO switch to ZERO. After 15 seconds, turn the OPTICS ZERO switch to ZERO. After 15 seconds, turn the OPTICS ZERO switch to ZERO. |
| 6.2.12.8.2.5 | Again sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to bring the SXT StLOS horizontal reticle and autocollimator horizontal filar images to coincide. Record the autocollimator reading. |

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| 6.2.14.6 | | |
| Outer Gimbal Response Test. | | |
| 6.2.14.6.1 | | |
| Enter code 2026000000 in C-START Module 4A1-A5-C156. Press XEQ/SEAL Pushbutton to call up CG 2177 OGA SERVO ERROR on 4A1-A3-CH1. | | |
| 6.2.14.6.2 | | |
| Enter VERB 41 NOUN 20 into K148. Press ENTER. | | |
| 6.2.14.6.3 | | |
| Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds. | | |
| 6.2.14.6.4 | | |
| Enter VERB 42 into K148. Press ENTER pushbutton. | | |
| 6.2.14.6.5 | | |
| Enter +00000 into K148 three times. Press ENTER after each entry. Wait 90 seconds. | | |
| 6.2.14.6.6 | | |
| Enter 0010 into 4A2-A6-R155. The top half of the switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated. | | |
| 6.2.14.6.7 | | |
| Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the OG Stabilization Loops. | | |
| NOTE: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the O/W POWER IMU switch on the LEB Lighting Control Panel to OFF. | | |
| 6.2.14.6.8 | | |
| Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec. | | |
| 6.2.14.6.9 | | |
| Enter 0000 into 4A2-A6-R155. The top half of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the OG Stabilization Loop. | | |
| 6.2.14.6.10 | | |
| After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to 5% of the original step amplitude. In addition, record the total number of overshoots. | | |
| 6.2.14.6.10.1 | | |
| The outer gimbal stabilization loop response time shall be less than 0.1 second. | | |
| 6.2.14.6.10.2 | | |
| The maximum number of overshoots on the OGA Servo Error Signals shall be five. | | |
| 6.2.14.7 | | |
| Enter VERB 40 NOUN 20 into K148. Press the ENTER pushbutton. | | |
| 6.2.14.7.1 | | |
| Enter VERB 41 NOUN 20 into K148. Press the ENTER pushbutton. | | |

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| | | |

6.2.18.5 To change the launch azimuth perform the following:

- VERB 78, ENTER
- R1 displays present launch azimuth
- To change launch azimuth enter
VERB 21, ENTER
±XXX.XX ENTER (New launch azimuth)

NOTE: During the beginning of Prog. 02 as to initial start time, record OPEN, CLUT, and CDUZ every 15 minutes for 120 min and every 5 minutes for the next 30 minutes.

6.2.18.6 Enter VERB 33, ENTER into the DSKY. On the DSKY observe the PROGRAM display change to 05 after approximately 90 seconds. Approximately 5 minutes later observe the PROGRAM display change to 02. When PROG display changes to 02 record time as T_0 .

6.2.18.7 Gyro Compassing Stability

6.2.18.7.1 120 minutes after T_0 record the Outer, Inner and Middle CDU Gimbal angles from the CRT.

6.2.18.7.2 Repeat above step every 5 minutes for the next 120 minutes.

6.2.18.7.3 The peak to peak spread of the outer gimbal angle shall not exceed 0.12° .

6.2.18.7.4 The peak to peak spread of the Inner and Middle gimbal angles shall not exceed 0.06° .

6.2.18.8 Gyro Compassing Accuracy

6.2.18.8.1 After 240 minutes from T_0 set the OPTICS ZERO switch on the G&N Indicator to ZERO.

6.2.18.8.2 Enter the following into the DSKY:

| | | |
|---------|---------|-------------------------|
| VERB 21 | NOUN 03 | ENTER |
| 02553 | | ENTER |
| +XXX.XX | ±000.01 | ENTER (Target No. 1 AZ) |
| | | ENTER |
| 02554 | | ENTER |
| +00.000 | | ENTER (Target No. 1 EL) |
| | | ENTER |
| 02555 | ±000.01 | ENTER (Target No. 2 AZ) |
| | | ENTER |
| 02556 | | ENTER |
| +00.000 | | ENTER (Target No. 2 EL) |

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- 6.2.18.8.2
 (Continued) On the G&N Indicator Control Panel, set the Optics ZERO switch to OFF and the controller speed to HI. Drive the StLOS to the approximate position to Target No. 1. Set the Controller Speed switch to LO.
- NOTE: Repeat the following 10 steps before proceeding. These are time critical steps and must be performed as rapidly as possible.
- 6.2.18.8.3 Enter VERB 65, ENTER into DSKY. Observe the PROGRAM display on the DSKY change to 03.
- 6.2.18.8.4 When VERB 06 NOUN 41 flashed on the DSKY, insure that R1 and R2 display Target 1 azimuth and elevation.
- a. R1 = +XXX.XX (Target 1 azimuth)
 b. R2 = +XX.XXX (Target 1 elevation)
- 6.2.18.8.5 Verify the data appearing in R1 and R2 and if correct, proceed. If not correct, perform the following sequence:
- a. VERB 24, ENTER
 b. +XXX.XX, ENTER (Target 1 azimuth)
 c. +XX.XXX, ENTER (Target 1 elevation)
- 6.2.18.8.6 After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY.
- 6.2.18.8.7 When VERB 06 NOUN 41 flashes on the DSKY, insure that R1 and R2 display Target 2 azimuth and elevation.
- a. R1 = XXX.XX (Target 2 azimuth)
 b. R2 = XX.XXX (Target 2 elevation)
- 6.2.18.8.8 Verify the data appearing in R1 and R2 and if correct, perform the following sequence:
- a. VERB 24, ENTER
 b. +XXX.XX, ENTER (Target 2 azimuth)
 c. +XX.XXX, ENTER (Target 2 elevation)
- 6.2.18.8.9 After the correct readings for R1 and R2 are verified enter VERB 33, ENTER into the DSKY.
- 6.2.18.8.10 Using the Optics Hand Controller, align the SXT StLOS to Target 1 and press MARK pushbutton. If satisfied that the MARK was good, press the ENTER push button. If not satisfied with MARK, press the MARK REJECT pushbutton and repeat this step.

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| 6.2.19.3 | | |
| 6.2.19.3.1 | | |
| 6.2.19.4 | | |
| 6.2.19.5 | | |
| 6.2.19.6 | | |
| 6.2.19.7 | | |
| 6.2.19.8 | | |
| 6.2.19.9 | | |
| 6.2.19.9.1 | | |
| 6.2.19.10 | | |
| 6.2.19.11 | | |
| 6.2.19.12 | | |
| 6.2.19.13 | | |
| 6.2.19.14 | | |
| 6.2.19.15 | | |

- Into R154 insert 0001. Verify and execute.
- Into R153 insert 1100. Verify and execute.
- Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- Into C156 insert -050001234. Verify and execute. Verify on the CRT that GV0106 is between -4.0 and -6.0 VDC.
- Into R154 insert 0111. Verify and execute.
- Observe CG 1020, +14 VDC CMC Power Supply and CG 1030, +4 VDC CMC Power Supply, on the CRT. Repeat 6.2.19.3 through 6.2.19.6 adjusting each C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC and CG 1030 is +3.40 (+0.03 - 0.00) VDC.
- Initiate CMC Self Check by inserting the following into K146:
- a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- Wait 300 seconds
- Insure that the DSKY RESTART lamp and Program Alarm lamp does not light.
- Into R154 insert 0101. Verify and execute.
- Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify the RESTART lamp on the DSKY is lighted. Disregard other DSKY indications. If RESTART does not light, repeat 6.2.19.3. Verify CMC Warning masters alarm are lighted.
- Set the INHIBIT VOLTAGE FAIL switch to ON. Insert the following into K146:
- a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- Into R154 insert 0001. Verify and execute.
- Into C156 insert +108001244. Verify and execute. Verify on the CRT that GV0116 is between +0.8 and +11.8 VDC.
- Into R154 insert 0111. Verify and execute.
- Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.12 through 6.2.19.14 adjusting the C-Start entry until CG 1020 is 16.4 (+0.0, -0.1) VDC.

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ADDENDUM II
COLOSSUS G&N System Tests

- Change 1 Delete the following sections or paragraphs when Colossus ropes are installed in the S/C.
- Deleted.
 - 6.2.2.1 thru 6.2.2.2
 - Deleted.
 - 6.2.2.11 thru 6.2.2.11.4
 - Deleted.
 - Deleted.
- Change 2 Substitute this paragraph for paragraph 6.2.5.1.3.1 when Colossus flight ropes are installed in the S/C.
- 6.2.5.1.3.1 On K-148 enter the following:
- VERB 21 NOUN 01 ENTR
00034 ENTR
00000 ENTR
Verify GIMBAL LOCK and PGNS CAUTION lights go out.
- VERB 21 NOUN 01 ENTR
00773 ENTR
40000 ENTR
- Verify that NO ATT indication is OFF.
- Change 3 Replace Figure 1 and Table I and II with the following when Colossus flight ropes are installed in the S/C.
- See Attachment.

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- 6.2.10.13 Insert the Inflight Tool (V36601405) into the Shaft Tool Input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to -3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool.
- 6.2.10.14 Insert the Inflight Tool (V36601405) into the Trunnion Tool Input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool.
- 6.2.11 OPTICS Coordinate Transformation Control Test.
- 6.2.11.1 Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.
- NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding.
- INITIALIZATION
- 6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.
- a. TELESCOPE TRUNNION to SLAVE to EXT
 - b. CONTROLLER COUPLING to DIRECT
 - c. CONTROLLER SPEED to HI
 - d. OPTICS MODE to MAN
- 6.2.11.9 Record time. Quickly displace the OPTICS CONTROL STICK 45±10 degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at 45±10 deg. When Target leaves the SCT upper right field of view press MARK pushbutton. The PROG alarm light shall light.
- 6.2.11.10 From the uplink file tape, the compressed data tape, or the PCM tape request a data reduction of the shaft CDU register (address 26) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) and the PROG alarm discrete for the period during which the OPTICS CONTROL STICK was being displaced above. The shaft CDU angle shall be 225±10.00 degrees at the time the PROG alarm occurred. The elapsed time from time of OPTICS CONTROL STICK displacement to the time the PROG alarm discrete is obtained shall be 19 to 32 seconds.

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CSC AMPLIFIER SHAFT AND TRUNNION DRIVE TEST

- 6.2.11.11 Set the CONTROLLER COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the optics until R1 = +225.00 and R2 = +10.000. Set the CONTROLLER COUPLING switch to RSLV.
- 6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.
- 6.2.11.13 Set the CONTROLLER COUPLING switch on the G&N Panel to DIRECT. Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN.
- 6.2.11.13.1 Perform the following to remove the "MARKING SYSTEM IN USE" Bit of EXTVBACT registers.
- 6.2.11.13.1.1 Enter the following into the K-Start:
- VERB 01 NOUN 01, ENTER
 - 00766 ENTER
Record R1 = XXXXY
- 6.2.11.13.1.2 Enter the following into the K-Start:
- VERB 21 NOUN 01 ENTER
 - 00766, ENTER
 - XXXXY', ENTER where Y' is determined from Table II and XXXX is that recorded in 6.2.11.13.1.1.

TABLE II

| Y (From 6.2.11.13.1.1) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|------------------------|---|---|---|---|---|---|---|---|
| Y' | 0 | 0 | 1 | 4 | 5 | 4 | 5 | |

- 6.2.11.3 Deleted. Following into the K-Start to monitor the CONTROLLER COUPLING switch.
- VERB 11 NOUN 01 ENTER
- 6.2.11.3.1 Deleted. The following to remove the "MARKING SYSTEM IN USE" Bit of EXTVBACT registers.

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6.2.11.3.1.1 Deleted. following into the K-12 list:

```

1: 0001, 01  NOUN 01,  ENTER
2: 00766,  ENTER
3: 0000 001 = 000000

```

6.2.11.3.1.2 Deleted. Following into the E-Start:

- a. $\text{MSE}(\hat{\mu}_N) = \frac{1}{N} \sum_{n=1}^N \text{MSE}(\hat{\mu}_{n|N})$
- b. $\text{MSE}(\hat{\mu}_N)$ vs. N
- c. $\text{MSE}(\hat{\mu}_N)$, $\text{MSE}(\hat{\mu}_{N-1})$ where N is determined from Table I and MSE is that recorded in d. e. 4.0.3.1.1.

TABLE I

[illegible]

6.2.11.4 Set the OPTICS MODE switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS MODE switch to MAN.

6.2.11.5 Set up the analog recorders to monitor the following measurements:

2. CG 3170 SCT Trunnion Tachometer Output

RESOLVED MODE PHASING AND IMAGE RATE TEST

6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until $R1 = +225.00$ and $R2 = +10.000$ on the CRT and the DSKY's.

6.2.11.7 Set the **CONTROLLER COUPLING** switch on the **G&N Panel** to **RSLV** and the controller speed switch to **MED**.

6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.

Change 14 **Replace section 6.2.12 with the following:**

6.2.12 OPTICS FUNCTIONAL TEST

6.2.12.1 Deleted.

6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:

a. +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8 ± 3 VDC. Record the indication on the CRT.

b. CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.

c. CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT.

APOLLO GAN Specification
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 Original Issue Date: 17 FEB 67
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 Class 4 Release

POST INSTALLATION CHECKOUT PROCESS
 SPECIFICATION FOR THE APOLLO GUIDANCE &
 NAVIGATION SYSTEM BLOCK II-KSC

Record of Revisions

| Date | Revision Letter | TDR No. | Pages Revised | Approval |
|---------|-----------------|---------|--|----------|
| 8/11/67 | A | 33750 | 10-12, 15, 24, 35-46, 51-56, 59-67, 73-78, 81, 82, 84-86, 91, 95-97, 99-102, 105-119. Was 119 pages, now 120. | EA |
| 9/29/67 | B | 34782 | 2-128; Specification was 128 pages, now 129 pages. | EA |
| 1/16/68 | C | 35445 | Completely revised. Specification was 129 pages, now 174 pages. | EA |
| 1/22/68 | D | 35470 | 8, 22, 27, 43, 63, 64, 68, 78, 108, 109, 111, 127, 162-164 | EA |
| 2/23/68 | E | 35753 | 2, 17, 21, 23, 25, 27-32, 43, 46-53, 59, 62, 63, 65, 72, 73, 76-78, 82, 83, 85, 86, 88, 89, 96, 100, 103, 108, 109, 141, 142, 161-164, 171-174 | EA WLS |

This specification consists of page 1 to 174 inclusive.

| APPROVALS | NASA/MSC | Signature | Signature |
|-----------|----------|--------------------|--------------------|
| | | <i>[Signature]</i> | <i>[Signature]</i> |

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1. INTRODUCTION

1.1 The individual Spacecraft (SC) installed Guidance and Navigation (G&N) System to be checked out per this process specification shall consist of one of each of the following major assemblies: The applicable part numbers shall be determined by drawing No. 2014999.

- 1 - Optical Unit Assembly
- 1 - Navigation Base Assembly, Block II
- 1 - Inertial Measurement Unit (IMU) & FIPA Elect. Assy.
- 1 - Power and Servo Assembly (PSA)
- 1 - Apollo Guidance Computer Group
- 1 - G&N Interconnect Harness Assembly
- 1 - Signal Conditioner Assembly
- 1 - Display and Control Group (D & C)
- 1 - Coupling Data Unit

1.2 The G&N System herein shall be identified as a Block II system. The computer contains the program flight ropes in the core rope memory. The test requirements herein are based on Sundisk Rev. 282.

2. SCOPE

2.1 This specification outlines the checkout requirements for the G&N System installed in the Apollo Command Module Spacecrafts and tested in the VAB or on the PAD.

2.2 This document is to be used as technical support for all Block II G&N System test documentation for Command Module spacecraft testing. This document shall be amended by addendum to support applicable hardware, mission or program differences.

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- 5.10 The test equipment listed in paragraph 4.1 shall be connected and ready for operation before the tests of this specification are initiated.
- 5.11 Data Records
- 5.11.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance readings shall be recorded and flagged by appropriate symbols.
- 5.11.1.1 All test data obtained while demonstrating the requirements of this document shall be permanently recorded and forwarded to the next receiving agency.
- 5.11.1.2 A record of the amount of time each of the four prime power busses are on shall be kept and forwarded to the next receiving agency.
- 5.12 Interface
- 5.12.1 The APOLLO G&N System shall interface with accepted ECS and EPS distribution systems for power and environment control purposes and with the SCS or SCS substitute system for signal interface in accordance with the applicable ICD's.
- 5.13 General System Operating characteristics.
- 5.13.1 The program does not automatically display computer error codes when a PROG alarm occurs. If error code is desired enter the following on K-148 and then observe the DSKY display.
- VERB 05 NOUN 09 ENTR
- R1 = FAILREG
R2 = FAILREG +1
R3 = FAILREG +2
- 5.13.2 The DSKY "NO ATT" lamp illuminates any time the system is in the Coarse Align Mode, IMU Cage, or during turn on.

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- 6.2 Test Procedures
- 6.2.1 Application of Standby Power to G&N System
- 6.2.1.1 All power and control switches on the G&N Indicator Control Panel shall be placed in the OFF or neutral position.
- 6.2.1.2 The Portable Temperature Controller (PTC), shall be supplying inertial component heater power to the G&N System through the PSA, Connector No. 45J2.
- 6.2.1.3 Computer Power On
- 6.2.1.3.1 Set the POWER-AC1 and AC2 breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in), and position G/N POWER switch to AC1.
- 6.2.1.3.2 Set the G&N COMPUTER MN A and MN B Breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in).
- 6.2.1.3.3 Set the computer numerical display lights to the minimum acceptable brightness by rotating the Brightness Controls on the MDC and LEB Lighting Control Panels.
- 6.2.1.3.4 The +28 VDC CMC OPERATE voltage (CG 1520) shall be $+28.8 \pm 3$ VDC. Verify CRT indication. On DSKY verify TEMP light is ON. On the G&N Indicator Control Panel verify PGNS light is ON.
- 6.2.1.3.5 The voltage output of the +4 VDC CMC supply shall be $+4.00 \pm 0.20$ VDC, (CG1030). The value on the CRT shall be recorded.
- 6.2.1.3.6 The voltage output of the +14 VDC CMC supply shall be $+14.0 \pm 0.4$ VDC, (CG1020). The value on the CRT shall be recorded.
- 6.2.1.3.7 Using DSKY, enter VERB 36, ENTR, then press RESET. Verify that R1, R2, R3, VERB, NOUN, and PROG are blank.
- 6.2.1.3.8 IMU HTR Heater Power On
- 6.2.1.3.8.1 Enter the IMU Standby Mode of operation by engaging the IMU HTR MN A and MN B breakers on the Right Hand Circuit Breaker Panel (breakers pushed in).
NOTE: Restart Lamp may illuminate, if it does, disregard and press RSET on the DSKY.
- 6.2.1.3.8.2 Verify that the IMU +28 VDC STANDBY discrete lamp on Event Module is illuminated (CG 1513). On DSKY verify TEMP light is extinguished. On the G&N Indicator Control Panel verify PGNS light is extinguished.

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6.2.2 CMC Operational Test

NOTE: Verify that IMU STANDBY power (including CMC operate power) is applied, IMU OPERATE Power is not applied. (G/N IMU HTR MN A and MN B breakers engaged, Computer MN A and MN B breakers engaged, IMU MN A and MN B breakers disengaged, G/N Power-IMU switch on LEB Lighting Control Panel in OFF Position).

6.2.2.1 Using the LEB CMC DSKY, enter the following sequence of data into the CMC to initiate the DSKY check. Press the ENTER pushbutton after each entry (denoted by E).

VERB 36, E Press RESET

VERB 21 NOUN 27, E

77766, E

6.2.2.2 All the electroluminescent elements (PROG, VERB, NOUN, and Row 1, Row 2, Row 3) shall display the decimal number (9). Including the 9's, each of the following shall be displayed for approximately 5 seconds.

- 9's
- 8's
- 7's
- 6's
- 5's
- 4's
- 3's
- 2's
- 1's
- 0's
- Minus signs in Rows 1, 2, 3 (On concurrently for 5 sec)
- VERB-NOUN flashing (On concurrently for 5 sec)
- COMP ACTY (On concurrently for 5 sec)
- Plus signs in Rows 1, 2, 3 (On concurrently for 5 sec)
- VERB-NOUN flashing (On concurrently for 5 sec)
- COMP ACTY (On concurrently for 5 sec)
- COMP ACTY - On for 5 seconds, then DSKY blanks.

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- 6.2.2.4 DSKY Pushbutton Check
- 6.2.2.4.1 Enter the following sequence into the LEB CMC DSKY. Press the ENTER pushbutton after each entry (denoted by E).
- VERB 25 NOUN 01, E
 - 02100, E
 - +00123, E
 - 00456, E
 - 00789, E
- 6.2.2.4.2 The LEB CMC DSKY shall indicate +00123 in R1, -00456 in R2, and -00789 in R3.
- 6.2.2.4.3 Enter VERB 05, NOUN 01 into the LEB CMC DSKY. Press the ENTER pushbutton.
- 6.2.2.4.4 Enter 02100 into LEB CMC DSKY. Press the ENTER pushbutton. The LEB CMC DSKY shall indicate 00024 in R1, 77664 in R2, and 77576 in R3. Verify.
- 6.2.2.4.5 Enter the following sequence into the LEB CMC DSKY.
- VERB 21 NOUN 01, ENTER
 - 02100, ENTER
 - +00123, DO NOT press ENTER
- 6.2.2.4.5.1 Press the CLEAR pushbutton. R1 shall clear.
- 6.2.2.4.6 Enter VERB 04 NOUN 70 into the LEB CMC DSKY. Press the ENTER pushbutton. The operator Error Light shall light.
- 6.2.2.4.6.1 Press the RESET pushbutton. The Operator Error light shall extinguish.
- 6.2.2.4.7 Enter the following sequence into the LEB CMC DSKY. Press the ENTER pushbutton as indicated. The Key Release Light shall light.
- VERB 16, NOUN 20, ENTER
 - VERB
- 6.2.2.4.7.1 Press the KEY RELEASE pushbutton. The Key Release light shall extinguish.
- 6.2.2.4.7.2 Enter VERB 36, into the LEB CMC DSKY. Press the ENTER pushbutton.
- NOTE: 6.2.2.4.8 does not apply to 2TV-1.
- 6.2.2.4.8 Press the PRO pushbutton and verify the CH 32 on the CRT displays 5XXXX. Release the PRO pushbutton and verify that CH 32 on the CRT displays 7XXXX. NOUN 10, ENTER
- 00000, ENTER

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6.2.2.6 Deleted

6.2.2.7 Parity Fail Test

6.2.2.7.1 Enter the following into the K-Start. Press the ENTER pushbutton after each entry.

a. Deleted, ENTER

b. Deleted, ENTER

c. VERB 24 NOUN 02, ENTER

d. 02100 ENTER

e. 33777, ENTER

f. 04544, ENTER

g. VERB 25 NOUN 26, ENTER

h. 04000, ENTER

j. 01500 ENTER

k. 00004 ENTER

m. VERB 30, ENTER

The RESTART lamps on the MDC & LEB DESKY's shall illuminate. The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.

6.2.2.7.2 Press the ERROR RESET pushbutton on the K-Start. The RESTART & PGNS caution lamps shall extinguish.

6.2.2.7.3 Enter VERB 36, into the K-START. Press the ENTER pushbutton.

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6.2.2.8 Rupt Lock Test

6.2.2.8.1 Enter the following sequence into the K-Start. Press the ENTER pushbutton after each entry.

- a. VERB 24 NOUN 01, ENTER
- b. 02100, ENTER
- c. 30001, ENTER
- d. 01500, ENTER
- e. VERB 25 NOUN 26, ENTER
- f. 00001, ENTER
- g. 01500, ENTER
- h. 00004, ENTER
- i. VERB 31, ENTER

The RESTART and PROG lamps on the MDC and LEB DSKY's shall illuminate.
The PONS caution lamps on the MDC & LEB annunciator panels shall illuminate.
2. VERB 31, ENTER

6.2.2.8.2 Press the ERROR RESET pushbutton on the K-START. The RESTART & PONS caution lamps shall extinguish.

6.2.2.8.3 Enter VERB 36 into the K-Start. Press the ENTER pushbutton.

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6.2.2.9 TC Trap Test

6.2.2.9.1 Enter the following sequence into the K-Start. Press the ENTER pushbutton after each entry.

- a. VERB 21 NOUN 02, ENTER
- b. 02100, ENTER
- c. 01000, ENTER
- d. VERB 25 NOUN 26, ENTER
- e. 04000, ENTER
- f. 01000, ENTER
- g. 00004, ENTER
- h. VERB 30, ENTER

The RESTART and PROG lamps on the MDC & LEB DESKY's shall illuminate;
the PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.

6.2.2.9.2 Press the ERROR RESPT pushbutton on the K-Start. The RESTART & PGNS caution lamps shall extinguish.

6.2.2.9.3 Enter VERB 36 into the K-Start. Press the ENTER pushbutton.

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6.2.2.10 Nightwatchman Test

6.2.2.10.1 Enter the following sequence into the K-Start. Press ENTER pushbutton after each entry.

- VERB 24 NOUN 01, ENTER
- 03100, ENTER
- 30001, ENTER
- 01500, ENTER
- VERB 25 NOUN 26, ENTER
- 04000, ENTER
- 01500, ENTER
- 00004, ENTER
- VERB 30, ENTER

The RESTART and PROG lamps on the MDC & LEB DSKY's shall illuminate.
The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.
Nouns 1, 2, and 3 shall indicate error.

6.2.2.10.2 Press the ERROR RESET pushbutton on the K-Start. The RESTART & PGNS caution lamps shall extinguish.

6.2.2.10.3 Enter VERB 36 into the K-Start. Press the ENTER pushbutton.

6.2.2.11 Bank Sum Check

6.2.2.11.1 From a program listing for the installed CMC ropes, obtain a list of bank CKSM bugger words.

6.2.2.11.2 Enter VERB 91, ENTER into K148.

6.2.2.11.3 Record the following:

- R1 = Bank Sum
- R2 = Bank Number
- R3 = Bank CKSM bugger word

R1 shall be the same as R2, and R2 shall be the same as R3.
R3 shall equal the CKSM bugger word for the indicated bank.
Enter VERB 33, ENTER

6.2.2.11.4 Repeat 6.2.2.11.3 until all banks have been checked. Terminate the Bank Sum Test by entering VERB 34, ENTER into K148.

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- 6.2.2.12 CMC Clock Frequency Test.
- 6.2.2.12.1 Insure that CMC operate power has been applied for a minimum of 10 minutes before performing this test.
- 6.2.2.12.2 Verify that the counter is connected to the 3.2 kc signal on the hardline.
- 6.2.2.12.3 Insure that the counter has been warming up for a minimum of 30 minutes.
- 6.2.2.12.4 On the counter,
- Set the FUNCTION switch to: MAN START
Set the TIME BASE switch to: 1 usec TIME UNIT/COUNT
Set the SENSITIVITY control to: CHECK
- 6.2.2.12.5 Verify proper counter operation.
- 6.2.2.12.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.
- 6.2.2.12.7 Plug in the Preset unit and set:
- MODE switch to PRESET
N switches to 96000.
- 6.2.2.12.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.
- 6.2.2.12.9 Start counting by depressing RESET switch on counter.
- 6.2.2.12.10 After approximately 30 seconds, read and record counter display.
- 6.2.2.12.11 Repeat steps 6.2.2.12.9 and 6.2.2.12.10 nine times.
- 6.2.2.12.12 The average of the 10 previous readings shall be 30.000000±0.000060 seconds.
- 6.2.2.12.13 Insure that the system is not in IMU Operate.
- 6.2.2.12.14 Perform the following DSKY operations:
- VERB 37 ENTR 06
 ENTR/ENTR
- Press and hold the PRO pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is lighted.
- 6.2.2.12.15 Repeat steps 6.2.2.12.9 through 6.2.2.12.12.
- 6.2.2.12.16 Press and hold the PRO pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is not lighted.

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- 6.2.2.12.17 Perform the following DSKY operations:
VERB 37 ENTR
05 ENTR
- 6.2.2.13 Minimum Impulse Controller Input Test.
- 6.2.2.13.1 Enter the following into the DSKY.
a. VERB 11 NOUN 10, ENTER
b. 00032 ENTER
- 6.2.2.13.2 Set the Minimum Impulse Controller on the Indicator Control Panel to the following position and observe R1 of the DSKY for the proper indications.
- | MIC Position | R1 DSKY Indication |
|---------------------|--------------------|
| a. Up | 77775 |
| b. Down | 77776 |
| c. Left | 77737 |
| d. Right | 77757 |
| e. Clockwise | 77773 |
| f. Counterclockwise | 77767 |
| g. Neutral | 77777 |
- 6.2.2.13.3 Enter VERB 34, ENTER into the DSKY.
- 6.2.2.14 Mark and Mark Reject pushbutton test.
- 6.2.2.14.1 On the G&N Indicator Control Panel press and hold MARK pushbutton.
- 6.2.2.14.2 Observe PROG alarm lamp is lighted.
- 6.2.2.14.3 Enter the following in K-148:
VERB 11 NOUN 10 ENTR
00016 ENTR
- 6.2.2.14.4 Observe that DSKY row 1 displays 00040.
- 6.2.2.14.5 Release MARK pushbutton.
- 6.2.2.14.6 Observe that DSKY Row 1 displays 00000. Press ERR RSET pushbutton.
- 6.2.2.14.7 Press and hold the REJECT pushbutton on the G&N Indicator Control Panel.

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- 6.2.5.2.3 Energize the G&N COMPUTER MN A and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Press the STBY pushbutton on the DSKY for approximately 3 seconds. Verify +14 and +4 VDC AGC power supply outputs on CRT display. Voltages shall be +14±0.4V (CG1020) and +4±0.2 (CG1030). On DSKY verify TEMP light is ON. On the G&N Indicator Control Panel verify PGNS light is ON.
- 6.2.5.2.4 Set the G&N POWER AC1 and AC2 breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in). Set the G&N POWER AC1-OFF-AC2 switch to AC1.
- 6.2.5.2.4.1 Set the G&N DSKY and Display Panel brightness to the minimum acceptable level by manipulation of LIGHTS - NUMERICS control on both Left Hand Circuit Breaker panel and LEB Lighting Control panel.
- 6.2.5.2.5 Energize the G&N IMU HTR, MN A and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Insure that the CMC +28 VDC discrete lamp on the Event Module is illuminated (CG 1523). Verify TEMP light on DSKY is extinguished. Verify PGNS light on the G&N Indicator Control Panel is extinguished.
- 6.2.5.2.5.1 Set/Verify the following switches on the PSAAM.
- 6.2.5.2.6 Enter VERB 36 into K148. Press ENTER pushbutton. Press ERROR RESET pushbutton on K148. All computer alarms on the Main Display Console (MDC) and LEB AGC DSKY shall clear. Verify that DSKY R1, R2, R3, VERB, NOUN and PROG indications are blank. DSKY's are cleared. Verify PROG = 00.
- 6.2.5.2.7 Deleted. CMC graceful restart by entering the following sequence into the K-Start:
- a. VERB 92, press ENTER
b. 00016, press ENTER
- 6.2.5.2.8 Initiate CMC self-check by entering the following sequence into the K-Start:
- a. VERB 21 NOUN 27, ENTER
b. 77777, ENTER
c. VERB 16 NOUN 01, ENTER
d. 1366, ENTER
- 6.2.5.2.8.1 Monitor DSKY until R2 (SCOUNT +1) increments twice. If an error is detected, the PROGRAM ALARM lamp on the DSKY's shall light.
- 6.2.5.2.8.2 Terminate the monitor routine by entering the following into the DSKY:
VERB 34, ENTER.

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6.2.5.2.16 Verify that the CRT indications of the signals in Table VI are not flashing.

Table VI. Secondary Power Supply Voltages

| Measurement Number | Signal |
|--------------------|-----------------------------|
| 1 CG 1040 | +120 VDC PIPA SUPPLY |
| 2 CG 1051 | +20 VDC PIPA SUPPLY |
| 3 CG 1052 | -20 VDC PIPA SUPPLY |
| 4 CG 1070 | +4 VDC CDU SUPPLY |
| 5 CG 1100 | -28 VDC ELECTRONICS |
| 6 CG 1020 | +14 VDC CMC SUPPLY |
| 7 CG 1030 | +4 VDC CMC SUPPLY |
| 8 CG 1201 | IMU 28V 800 CPS 1 pot 0 pha |
| 9 CG 1202 | IMU 28V 800 CPS 5 pot ph A |
| 10 CG 1203 | IMU 28V 800 CPS 5 pot ph B |
| 11 CG 1331 | 3.2 KC 28V SUPPLY |
| 12 CG 1110 | 2.5 VDC TM BIAS |
| 13 CG 2301 | IRIG TEMPERATURE |

6.2.5.2.17 Monitor the PIPA Display Scope to insure that each PIPA is moding properly.

6.2.5.2.18 Perform 6.2.6 G&N Operational Test.

6.2.6 G&N Operation Test

6.2.6.1 Initial Conditions

6.2.6.1.1 Deleted.

6.2.6.1.2 Deleted. Following into K148.

- VERB 01 NOUIN 01, ENTER
 - 0000, ENTER
- Report 01 = AAAA and Run 1 Time.

6.2.6.1.3 Deleted. Following into K148.

- VERB 21 NOUIN 02, ENTER
 - 0000, ENTER
 - AAA-A, ENTER
 - VERB 02 NOUIN 02, ENTER
 - 0000, ENTER
- Report 01 = 0000

6.2.6.1.4 Deleted. Following into K148.

- 0000000000 = CG 0.0 (Group 1) (1, 2, 3, 4, 5, 6, 7, 8, 9, 0) (10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20) (21, 22, 23, 24, 25, 26, 27, 28, 29, 30) (31, 32, 33, 34, 35, 36, 37, 38, 39, 40) (41, 42, 43, 44, 45, 46, 47, 48, 49, 50) (51, 52, 53, 54, 55, 56, 57, 58, 59, 60) (61, 62, 63, 64, 65, 66, 67, 68, 69, 70) (71, 72, 73, 74, 75, 76, 77, 78, 79, 80) (81, 82, 83, 84, 85, 86, 87, 88, 89, 90) (91, 92, 93, 94, 95, 96, 97, 98, 99, 00)
 - 0000 = CG 0.0 = 0.00000000
 - 0000 = CG 0.0 = 0.00000000
- The signal order stated, changes, will be 0.0.

| | | | | | | | | | |
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Do not enter the GSF Operational Test within 15 minutes of the time calculated in 5.2.3.1.4.c. If the test is in process at this time, unacceptable results will occur.

6.2.6.2 Test Initiation

6.2.6.2.1 Enter VERB 92 into K148. Press the ENTER pushbutton.

6.2.6.2.2 Enter 00004 into K148. Press the ENTER pushbutton.

6.2.6.2.3 The NO ATT discrete shall appear momentarily then go OFF. Verify that the PROGRAM display on the CRT indicates 07. The program display on the CRT indicates 07.

NOTE: During this portion of the test the G&N System is exercised through its modes. Any failure will be indicated by the PROGRAM ALARM lamp on the DSKY's lighting.

6.2.6.2.4 After approximately 12 minutes, VERB 06, NOUN 98 will flash and the value of the gravity vector in cm/sec² shall be displayed in R1 and R2 on the CRT. Record these values.

6.2.6.2.5 R1 contains the first five digits of the gravity vector and R2 contains the last five digits. A decimal point shall be between them. The value for the gravity vector shall be $980.00000 \pm 05.00000 \text{ cm/sec}^2$.

6.2.6.2.6 Enter VERB 33 into K148. Press the ENTER pushbutton.

6.2.6.2.7 When VERB 06 NOUN 98 flashes the value of the horizontal earth rate shall be displayed in R1 and R2 on the CRT. Record these values.

6.2.6.2.8 R1 contains the first five digits of earth rate and R2 contains the last five digits. A decimal point shall be placed between them. R1 shall always be 00000. The horizontal earth rate shall be 00000,88000±0,1000 earth rate units.

6.2.6.3 Test Termination

6.2.6.3.1 Enter VERB 36 into K148. Press the ENTER pushbutton.

6.2.6.3.2 Enter VERB 41, NOUN 20 into K148. Press the ENTER pushbutton.

6.2.6.3.3 Enter +00000 into K148 three times. Press the ENTER pushbutton after each entry.

6.2.7 Gimbal Friction Test

6.2.7.1 Deleted. ~~Section 6.2.7.1, Deleted, is hereby deleted.~~

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6.2.7.1.1 Enter the following into the K-START:

| | | |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +17000 | ENTER | |
| +17000 | ENTER | |
| +17000 | ENTER | |

6.2.7.1.2 Verify on the CRT that R1 = +17000, R2 = +17000 and R3 = +17000. Wait 15 seconds and enter the following into the K-START:

| | | |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +27000 | ENTER | |
| +27000 | ENTER | |
| +27000 | ENTER | |

6.2.7.1.3 Verify on the CRT that R1 = +27000, R2 = 27000 and R3 = 27000. Wait 15 seconds and enter the following:

| | | |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +00000 | ENTER | |
| +00000 | ENTER | |
| +00000 | ENTER | |

6.2.7.1.4 Verify on the CRT that R1 = +00000, R2 = +00000 and R3 = +00000. Wait 15 seconds before proceeding.

6.2.7.2 Inner Gimbal Friction Test

6.2.7.2.1 Setup the ACF Analog Recorders to record the following measurements (use speed of 10 mm/sec):

| | |
|------------|---------------------------|
| a. CG 2120 | IG TORQUE MOTOR CURRENT |
| b. CG 2117 | IGA SERVO ERROR IN PHASE |
| c. CG 2112 | IG 1X RESOLVER OUTPUT SIN |
| d. CG 2113 | IG 1X RESOLVER OUTPUT COS |
| e. CG 2220 | IGA CDU FINE ERROR |
| f. CG 2221 | IGA CDU Coarse Error |

6.2.7.2.2 Enter the following sequence into the K-Start, pushing the ENTER pushbutton after each entry (+360 IG torquing).

| | | |
|------------|---------|-----------|
| a. VERB 21 | NOUN 01 | ENTR |
| b. 02500 | | ENTR |
| c. 00000 | | ENTR |
| d. NOUN 15 | | ENTR |
| e. 00000 | | ENTR/ENTR |
| f. 40000 | | ENTR/ENTR |
| g. 40034 | | ENTR/ENTR |
| h. 00000 | | ENTR/ENTR |
| i. 00000 | | ENTR |

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- 6.2.7.2.3 Enter the following sequence into K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (verify VERB 33 on CRT)
- 6.2.7.2.4 Start analog recorders.
- 6.2.7.2.5 Verify that IG Servo Error Quadrature (CG 2108) is 0.0 ± 1.2 Vrms. Observe measurement CG 2112, IG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders. Observe this measurement on the CRT.
- 6.2.7.2.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- VERB 40, NOUN 20, press ENTER
 - VERB 41, NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
- 6.2.7.2.7 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.2.8 Enter the following sequence into the K-Start. Push the ENTER push button after each entry (-360° IG torquing):
- VERB 24 NOUN 01 ENTER
 - 02502, ENTER
 - 37777, ENTER
 - 37743, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.2.9 Enter the following sequence into K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (verify VERB 33 on CRT).
- 6.2.7.2.10 Start analog recorders.
- 6.2.7.2.11 Observe measurement CG 2112, IG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.

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- 6.2.7.2.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- VERB 40, NOUN 20, press ENTER
 - VERB 41, NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
- 6.2.7.2.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.3 Outer Gimbal Friction Test.
- 6.2.7.3.1 Setup the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):
- CG 2180 OG TORQUE MOTOR CURRENT
 - CG 2177 OGA SERVO ERROR IN PHASE
 - CG 2173 OG 1X RESOLVER OUTPUT SIN
 - CG 2173 OG 1X RESOLVER OUTPUT COS
 - CG 2280 OGA CDU FINE ERROR
 - CG 2281 OGA CDU Coarse Error
- 6.2.7.3.2 Enter the following sequence into the K-Start. Pushing the ENTER push-button after each entry (+360° OG torquing):
- VERB 24 NOUN 01, ENTER
 - 02500, ENTER
 - 40000, ENTER
 - 40034, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.3.3 Enter the following sequence into K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (verify VERB 33 on CRT)
- 6.2.7.3.4 Start analog recorders
- 6.2.7.3.5 Observe measurement CG 2172, OG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders. Observe reading on the CRT.

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- 6.2.7.3.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- VERB 40, NOUN 20, press ENTER
 - VERB 41, NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
- 6.2.7.3.7 Verify that OG Servo Error Quadrature (CG 2168) is 0.0 ± 1.2 Vrms. Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.3.8 Enter the following sequence into the K-Start. Push the ENTER pushbutton after each entry (~360° OG torquing):
- VERB 24 NOUN 01, ENTER
 - 02500, ENTER
 - 37777, ENTER
 - 37743, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.3.9 Enter the following sequence into K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (verify VERB 33 on CRT)
- 6.2.7.3.10 Start analog recorders.
- 6.2.7.3.11 Observe measurement CG 2172, OG 1X resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorder.
- 6.2.7.3.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start:
- VERB 40, NOUN 20, press ENTER
 - VERB 41, NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - 06750, press ENTER
- 6.2.7.3.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = -06750. Wait 30 seconds before proceeding.

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6.2.7.4 Middle Gimbal Friction Test.

6.2.7.4.1 Setup the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):

- a. CG 2150 MG TORQUE MOTOR CURRENT
- b. CG 2147 MGA SERVO ERROR IN PHASE
- c. CG 2142 MG 1X RESOLVER OUTPUT SIN
- d. CG 2143 MG 1X RESOLVER OUTPUT COS
- e. CG 2250 MGA CDU FINE ERROR
- f. CG 2251 MGA CDU Coarse Error

6.2.7.4.2 Enter the following sequence into the K-Start. Push the ENTER pushbutton after each entry (+135° MG torquing):

- a. VERB 24, NOUN 01, ENTER
- b. 02504, ENTER
- c. 03777, ENTER
- d. 77777, ENTER

Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.

6.2.7.4.3 Enter the following sequence in the K-Start:

- a. VERB 42, press ENTER
- b. VERB 33, press ENTER (Verify VERB 33 on CRT)

6.2.7.4.4 Start the analog recorder.

6.2.7.4.5 Verify that MG Servo Error Quadrature (CG 2138) is 0.0 ± 1.2 Vrms.

6.2.7.4.6 Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs (approximately 5 minutes), stop the recorders. ~~When steady-state condition occurs (approximately 5 minutes), stop the recorders.~~

6.2.7.4.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.

- a. VERB 40 NOUN 20, ENTER
- b. VERB 41 NOUN 20, press ENTER
- c. +00000, press ENTER
- d. +00000, press ENTER
- e. +06750, press ENTER

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- 6.2.7.4.7 Enter the following sequence into the K-Start. Push ENTER pushbutton after each entry (-135° MG torquing):
- VERB 24 NOUN 01, ENTER
 - 02804, ENTER
 - 14000, ENTER
 - 00000, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.4.8 Enter the following sequence in the K-Start:
- VERB 42, press ENTER
 - VERB 33, press ENTER (Verify VERB 33 on CRT)
- 6.2.7.4.9 Start analog recorders.
- 6.2.7.4.10 Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When the steady-state condition occurs (approximately 5 minutes), stop the recorders.
- 6.2.7.4.11 Return the G&W System to the coarse align mode by entering the following sequence in the K-Start.
- VERB 40 NOUN 20, press ENTER
 - VERB 41 NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
- 6.2.7.5 Examine the traces of the recorded measurements for all six phases of this test to detect any sharp discontinuities. Disregard transients of 0.5 second duration or less on the Gimbal Torque motor current traces, and those less than 0.2 second on the CDU fine error measurement traces. The Gimbal Torque motor currents shall not exceed 0.125 amperes. The CDU Fine Error measurements shall not exceed ±70 mv rms. The CDU Coarse Error measurement shall not exceed ±680 mv rms.

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6.2.9.18 Enter VERB 33 into K148. Press the ENTER pushbutton. After approximately 30 seconds the following data shall be displayed on the CRT.

a. VERB 06 NOUN 06 flashing
b. R1 = 000xx
c. R2 = xxxxx

The GIMBAL LOCK lamp on the DSKY's shall extinguish. The PGNS Caution lamp on the Indicator Control Panel shall extinguish.

Record R1 and R2 as the Inner Gimbal CDU drive rate.
IG rate = $\frac{R1}{R2}$ /sec. The Inner Gimbal CDU drive rate shall be 1442" /sec.

6.2.9.19 Enter VERB 33 into K148. Press the ENTER pushbutton. After approximately 30 seconds the following data shall be displayed on the CRT.

a. VERB 06 NOUN 06 flashing
b. R1 = 000xx
c. R2 = xxxxx

Record R1 and R2 as the Outer Gimbal CDU drive rate.
OG rate = $\frac{R1}{R2}$ /sec. The Outer Gimbal CDU drive rate shall be 1442" /sec.

6.2.9.20 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall extinguish. After approximately 30 seconds VERB 21 NOUN 22 shall flash on the CRT. Enter +00100 into K148 three times. Press the ENTER pushbutton after each entry. The NO ATT lamp on the DSKY's shall momentarily light, then extinguish. After approximately 100 seconds VERB 01 NOUN 10 flashing shall be displayed on the CRT. Press the ENTER pushbutton.

Verify R1 = 33xxxx. Press the ENTER pushbutton. Verify R2 = xxxxxx.

The ISS WARNING Lamp on the Indicator Control Panel shall light.
The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be ON.

6.2.9.21 Enter VERB 33 into K148. Press the ENTER pushbutton. ISS WARNING and ISS CDU FAIL shall be OFF. After approximately 30 seconds VERB 21 NOUN 22 shall flash on the CRT. Enter +03375 into K148 three times. Press the ENTER pushbutton after each entry. The NO ATT lamp on the DSKY's shall momentarily light, then extinguish. After approximately 100 seconds VERB 01 NOUN 10 flashing shall be displayed on the CRT. Press the ENTER pushbutton.

Enter 00030 into K148. Press the ENTER pushbutton.
Verify R1 = 33xxxx.

The ISS WARNING lamp on the Indicator Control Panel shall light.
The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be ON.

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- 6.2.10.4.3 Set the OPTICS MODE switch to MAN. Press the KEY-REL pushbutton.
- OPTICS TIME TO ZERO TEST
- 6.2.10.5.1 Set up the Analog Recorder to monitor the following measurements.
- CG 3140 SXT Shaft Tach Output
 - CG 3150 SXT Trunnion Tach Output
 - CG 3160 SCT Shaft Tach Output
 - CG 3170 SCT Trunnion Tach Output
 - CG 3117 SXT Shaft Servo Error in phase
 - CG 3118 SXT Trunnion Servo Error in phase
 - CG 3119 SXT Shaft Servo Error in phase
 - CG 3120 SXT Trunnion Servo Error in phase
- 6.2.10.6 Push the Optics Hand Controller to the right, driving the SXT Shaft until R1 on the CRT indicates $+180 \pm 1^\circ$. Push the Optics Hand Controller up, driving the SXT Trunnion until R2 on the CRT indicates $+75 \pm 1^\circ$.
- 6.2.10.7 Start the Analog Recorders and set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO.
- 6.2.10.8 Monitor the Analog Recorders until all signals return to null. Stop the Analog Recorders. The elapsed time between the initial and final SXT Shaft and Trunnion Tach output null shall be less than 15 seconds. The peak magnitude of the SXT Shaft (CG 3140) and Trunnion (CG 3150) Tach Outputs shall be $-3.3 \pm 1.3V$ rms. The peak magnitude of the SCT Shaft Tach Output (CG 3160) shall be $+3.3 \pm 1.3V$ rms. The peak magnitude of the SCT Trunnion Tach Output (CG 3170) shall be $0.85 \pm 0.35V$ rms. The SXT SHAFT (CG 3117) and TRUNNION (CG 3118) Servo Error in Phase measurements shall each have a maximum magnitude of 2 VRMS.
- 6.2.10.9 Record R1 and R2 on the CRT. The data displayed shall be as follows:
- $+0.00^\circ \pm 0.02^\circ, -0.03^\circ$ (Shaft Angle)
 - $R2 = +0.000 \pm 0.006^\circ, -0.007^\circ$ (Trunnion LOS Angle)
- 6.2.10.10 Record the Telescope Panel Angle Counter Indications. The Shaft Angle shall be 0.0 ± 0.11 degrees. The Trunnion Angle shall be 0.0 ± 0.22 degrees.
- 6.2.10.11 Set the G/N Power Optics switch on the LEB Lighting Control Panel to OFF.

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| OPTICS BACKUP MODE TEST | | | | | | |
| 6.2.10.12 | Insert the Inflight Tool (V36601405) into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eyepiece while turning the tool until the TPAC reads +5°. Remove the tool from the Trunnion tool input. | | | | | |
| 6.2.10.13 | Insert the Inflight Tool (V36601405) into the Shaft Tool input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool. | | | | | |
| 6.2.10.14 | Insert the Inflight Tool (V36601405) into the Trunnion Tool input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool. | | | | | |
| 6.2.11 | OPTICS Coordinate Transformation Control Test. | | | | | |
| 6.2.11.1 | Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies. | | | | | |
| | NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding. | | | | | |
| INITIALIZATION | | | | | | |
| 6.2.11.2 | Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated. | | | | | |
| | a. OPTICS TEL TRUN to SLAVE to EXT | | | | | |
| | b. OPTICS COUPLING to DIRECT | | | | | |
| | c. OPTICS SPEED to HI | | | | | |
| | d. OPTICS MODE to MAN | | | | | |
| 6.2.11.3 | Enter the following into the K-Start: ENTER the OPTICS MODE. | | | | | |
| | VERB 16 NOUN 51 ENTR : ENTER | | | | | |
| 6.2.11.3.1 | Deleted. the following to set the UNARMED SYSTEM IN WITH IS A IN SELECT register. | | | | | |
| 6.2.11.3.1.1 | Deleted. following into the K-Start: | | | | | |
| | a. VERB 01 NOUN 01 ENTER | | | | | |
| | b. VERB 01 NOUN 01 ENTER | | | | | |
| | c. VERB 01 NOUN 01 ENTER | | | | | |

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6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.

6.2.11.13 Set the OPTICS COUPLING switch on the G&N Panel to DIRECT.
Set the OPTICS ZERO switch to ZERO.

8. 2. 13. 12. 1 Perform the following to remove the "WARNING SYSTEM IN USE" bit of REDUNDANCY port status:

6.3.11.1.1.1 Enter the following key the M-Start:

- a. VERB 0: NOUN 01, ENTIRE
b. 00768, ENTIRE
Record R1 = XXXXX

1.1.1.1.2 Enter the following "b" to the F-Chart:

- a. VERB 21, NOUN 21, ENTER
 b. 99766, ENTER
 c. XXXXX, ENTER where \sqrt{V} is determined from Table W and
 d. NOUN is not recorded in 6.2.11.13.1.1.

TABLE 1

| | | | | | | | |
|-------------------|---|---|---|---|---|---|---|
| Y from 6.2.11.20. | | | | | | | |
| Y | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

NOTE: If codes to the left will not continue past the "N" for NO CODES, switch on the "NO CODE" indicator.

6.2.12 OPTICS FUNCTIONAL TEST

6.2.12.1 Deleted.

6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:

- a. +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8±3 VDC. Record the indication on the CRT.
- b. CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.
- c. CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT.

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SHAFT SLEW RATE - HI SPEED

6.2.13.6 Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.

NOTE: Read and understand step 6.2.13.7 before proceeding. Do not hold Control Stick at right limit for more than 10 seconds or exceed a shaft angle of 250°.

6.2.13.7 Record time. Push and hold the Optics Control stick to its right limit. After approximately 7 seconds release the control stick.

6.2.13.8 Perform the following calculations:

From the uplink file tape, the compressed data tape or the PCM tape, request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Shaft slew rate shall be 19.5±3.9 deg/sec.

TRUNNION SLEW RATE - MED SPEED

6.2.13.9 Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS SPEED switch to MED.

NOTE: Read and understand 6.2.13.10 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.

6.2.13.10 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.

6.2.13.10 Record the SIXT TRUN MTR Control winding (CG 3155) signal on the CRT while slewing the optics. The voltage shall be +0.25 to 2.00 VRMS.

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- 6.2.13.11** Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU registers (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Trunnion slew rate shall be 1.0 ± 0.2 deg/sec.
- SHAFT SLEW RATE - MED SPEED**
- 6.2.13.12** Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.
- NOTE:** Read and understand 6.2.13.13 before proceeding. Do not hold control stick at right limit for more than 20 seconds.
- 6.2.13.13** Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.
- Record the SXT SHAFT MTR control winding (CG 3145) signal on the CRT while slewing the optics. The voltage shall be $+0.25$ to 2.00 VRMS.
- 6.2.13.14** Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Shaft slew rate shall be 2.0 ± 0.4 deg/sec.
- TRUNNION SLEW RATE - LO SPEED**
- 6.2.13.15** Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS SPEED switch to LO.
- NOTE:** Read and understand 6.2.13.16 before proceeding. Do not hold control stick at upper limit for more than 30 seconds.

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- 6.2.14 Stabilization Loop Step Response Test.
- 6.2.14.1 Proceed with this test if the Operate Power On Test of 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform the Turn On Procedure of 6.2.5.2 before proceeding.
- 6.2.14.2 Insure that the Carry-on Command Stimuli Unit, Model No. C14-200, is installed and connected.
- 6.2.14.3 Enter VERB 36 into K148. Press the ENTER pushbutton, then the ERROR RESET pushbutton.
- 6.2.14.4 Inner Gimbal Response Test.
- 6.2.14.4.1 Enter code 2032000000 in C-START Module 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2117 IGA SERVO ERROR on 4A1-A5-CH1.
- 6.2.14.4.2 Enter VERB 41 NOUN 20 into K148. Press ENTER pushbutton.
- 6.2.14.4.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.4.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.4.5 ~~Deleted 00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.~~
- 6.2.14.4.6 Enter 0001 into R154. Verify and execute to apply +25 VDC ACR ENABLE to the PSAAM.
- 6.2.14.4.7 Enter 1000 into R155. Verify and execute to enter a DC step into the IG stabilization loop.
- CAUTION: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.4.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.4.9 Enter 0000 into 4A2-A6-R155; the top part of switch should be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the IG Stabilization Loop. The bottom part of switch shall be extinguished.
- 6.2.14.4.10 After the transient has died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.

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- 6.2.14.4.10.1 The inner gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.4.10.2 The maximum number of overshoots on the IGA Servo Error signals shall be three.
- 6.2.14.5 Middle Gimbal Response Test.
- 6.2.14.5.1 Enter code 2028000000 into C-START MODULE 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2147 MGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.5.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.5.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.5.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.5.5 Deleted. ~~Enter 0100 into K148 three times. Press ENTER after each entry. Wait 30 seconds.~~
- 6.2.14.5.6 Enter 0100 into 4A2-A6-R155. The top part of switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.5.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the MG Stabilization Loop.
- CAUTION: If the transient caused by the step input does not die within 15 seconds, remove the IMU OPERATE power by setting the G/W POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.5.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.5.9 Enter 0000 into 4A2-A6-R155. The top part of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.
- 6.2.14.5.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.5.10.1 The middle gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.5.10.2 The maximum number of overshoots on the MGA Servo Error signals shall be three.

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- 6.2.14.6 Outer Gimbal Response Test.
- 6.2.14.6.1 Enter code 2026000000 in C-START Module 4A1-A5-C156. Press XEQ/SEAL Pushbutton to call up CG 2177 OGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.6.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.6.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.6.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.6.5 Deleted: 0000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.6.6 Enter 0010 into 4A2-A6-R155. The top half of the switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.6.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the OG Stabilization Loops.
- NOTE: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/M POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.6.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.6.9 Enter 0000 into 4A2-A6-R155. The top half of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the OG Stabilization Loop.
- 6.2.14.6.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.6.10.1 The outer gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.6.10.2 The maximum number of overshoots on the OGA Servo Error Signals shall be five.
- 6.2.14.7 Enter VERB 40 NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.14.7.1 Enter VERB 41 NOUN 20 into K148. Press the ENTER pushbutton.

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- 6.2.15.19 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position -00003).
- 6.2.15.20 Repeat steps 6.2.15.8 through 6.2.15.19 twice to obtain second and third set of data.
- 6.2.15.21 Terminate this test by entering in K-148: VERB 34 ENTER
- 6.2.15.22 The average of the three readings of Scale Factor Error for the 6 positions shall be 0±1750 PPM.
- 6.2.15.23 After completion of all test numbers, stop the analog recorders.
- 6.2.15.24 Enter VERB 40 NOUN 20, ENTER into K148.
- 6.2.15.25 Enter the following into K148:
- VERB 41 NOUN 20, ENTER
 - +00000, ENTER
 - +00000, ENTER
 - +00000, ENTER
- 6.2.16 IMU Performance Test
- 6.2.16.1 Proceed with this test if the Operate Power On Test of 6.2.3 or the Turn On Procedure of 6.2.5.2 has been completed and system operation has not been interrupted. If the system operation has been interrupted, perform Turn On Procedure of 6.2.5.2 before proceeding with this test.
- 6.2.16.2 Deleted, VERB 01 NOUN 10 into K148. Press the ENTER pushbutton. Enter 00000 into K148. Press the ENTER pushbutton. Record R1 = AAAAA and the time of day.
- 6.2.16.3 Deleted, VERB 21 NOUN 01 into K148. Press the ENTER pushbutton. Enter 0.100 into K148. Press ENTER. Enter AAAA into K148. Press ENTER.
- 6.2.16.4 Deleted, VERB 06 NOUN 02 into K148. Press ENTER. Enter 0.100 into K148. Press ENTER. Record R1 = BBSTB.
- 6.2.16.5 Deleted, the following calculations:
- $R1 - (0.00000 \times 0.100) = CCCC.C$ (Res. in high order sensor channel 5) 059.
 - $23.0 - CCCC.C = DDDDD$ Res.
 - Add DDDDD to time of day recorded in step 1.

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Do NOT enter any of the RIPA scale factor tests until 10.0 hours after the time of day calculation in step 6.2.16.5. This is the time when the high order scale factor channels will overflow. If a RIPA scale factor test is being performed at this time, unacceptable test results will occur.

- 6.2.16.6 Verify that the IMU Operate Power has been applied for at least one hour.
- 6.2.16.7.1 Deleted.
- 6.2.16.7.2 Deleted.
- 6.2.16.7.4 Enter 00001 into K148. Press the ENTER pushbutton.
- 6.2.16.7.5 On the CRT DSKY display VERB 06 NOUN 41 shall flash. Verify R1 (Nav Base Azimuth) and R2 (Site Latitude) are correct.
- 6.2.16.7.6 If values for R1 and R2 are correct, proceed to next step. If values for R1 and R2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR
+XXX.XX ENTR (Correct navigation base azimuth ± 0.50 deg)
+XX.XXX ENTR (Correct site latitude from Table XX)
Verify values in R1 and R2 are correct.

TABLE XX

| LOCATION | LATITUDE |
|----------|----------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC-MSO | +28.523 |
| KSC-VAB | +28.585 |
| KSC-PAD | +28.607 |

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- 6.2.16.7.16 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (+NBDZ) position +00002.
- 6.2.16.7.17 On K-148 enter the following sequence:
VERB 33 ENTR
- 6.2.16.7.18 In approximately 90 secs. VERB 06 NOUN 98 shall flash. From the CRT, record R1 and R2 (-X PIPAG) Position +00002.
- 6.2.16.7.19 Deleted - enter the following sequence:
VERB 21 NOUN 01 ENTR
00100 ENTR
07757 ENTR
VERB 21 NOUN 01 ENTR
00411 ENTR
00020 ENTR
VERB 33 ENTR
- 6.2.16.7.20 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (-NBDX + ADIAX) Pos. +00002. Record CRT CDU gimbal angle indications and time.
- 6.2.16.7.21 On K-148 enter the following sequence:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.7.22 On CRT, DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00003.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00003 ENTR (Test Position Entry)
- 6.2.16.7.23 On K-148 enter the following sequence:
VERB 33 ENTR
- 6.2.16.7.24 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (-NBDX) Position +00003.
- 6.2.16.7.25 On K-148 enter the following sequence:
VERB 33 ENTR

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6.2.16.7.26 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2 (+Z PIPAG) Position +00003.

6.2.16.7.27 On K-148 enter the following sequence:

VERB 34 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.28 On the CRT, DSKY display verify R1 = +00900, R2 = 00000, and R3 = +00004.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00004 ENTR (Test Position Entry)

6.2.16.7.29 On K-148 enter the following sequence:

VERB 33 ENTR

6.2.16.7.30 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (+NBDY + ADSRAY) Position +00004.

6.2.16.7.31 On K-148 enter the following sequence:

VERB 33 ENTR

6.2.16.7.32 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2 (-Z PIPAG) Position +00004.

6.2.16.7.33 Deleted. Enter the following sequence:

VERB 21 NOUN 01 ENTR
03125 ENTR
80229 ENTR
VERB 21 NOUN 01 ENTR
02417 ENTR
77737 ENTR
VERB 33 ENTR

6.2.16.7.34 In approximately 67 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display record R2 (+NBDZ + ADIAZ) Position +00004. Record CRT CDU gimbal angle indications and time.

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6.2.16.7.45 On K-148 enter the following sequence:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.46 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00007.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2, and R3 are incorrect, enter the following sequence into K-148:
VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00007 ENTR (Test Position Entry)

6.2.16.7.47 On K-148 enter the following sequence:
VERB 33 ENTR

6.2.16.7.48 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (+.707 ADSRAK-NBDX) Position +00007.

6.2.16.7.49 On K-148 enter the following sequence:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.50 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00008.

6.2.16.7.51 On K-148 enter the following sequence:
VERB 33 ENTR

6.2.16.7.52 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 [+.707 (NBDZ + NBDY) +0.5 (ADIAZ - ADIAY) +0.5 (ADSRAY + ADSRAZ)] . Position +00008.

6.2.16.7.53 On K-148 enter the following:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.7.54 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00009.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00009 ENTR (Test Position Entry)

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- 6.2.16.7.55 On K-148 enter the following sequence:
VERB 33 ENTR
- 6.2.16.7.56 In approximately 17 minutes VERB 06 NOUN 96 shall flash. From the CRT DSKY display, record R2 (-NEDZ + .707 ADSRAZ) Position +00009.
- 6.2.16.7.57 On K-148 enter the following sequence:
VERB 34 ENTR
VERB 06 NOUN 96 shall flash
- 6.2.16.7.58 On the CRT DSKY display, verify R1 = +00900; R2 = +00000, and R3 = +00010:
If values for R1, R2, and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00010 ENTR (Test Position Entry)
- 6.2.16.7.59 On K-148 enter the following sequence:
VERB 33 ENTR
- 6.2.16.7.60 In approximately 12 minutes VERB 06 NOUN 96 shall flash. From the CRT DSKY display record R2 .707 (NBDY - NBDX) +.5 (ADLAX - ADLAX) +.5 ADSRAZ Position +00010.
- 6.2.16.7.61 Terminate this test by entering in K-148 the following:
VERB 36 ENTR
- 6.2.16.7.62 On K-148 enter the following sequence:
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR
- 6.2.16.8 Deleted
- 6.2.16.9 Deleted
- 6.2.16.10 Calculations

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6.2.16.10.5 Compute the PIPA Scale Factor error in parts per million from the values recorded in 6.2.16.10.1 and record in Table X_1 .

- a. PIPA S.F. Error = $\frac{2 \text{ local } g}{+PIPAG - (-PIPAG)} - 1.000000$ 10^6
- b. X PIPA S.F. Error = $\frac{2 \text{ local } g}{\text{line 2} - \text{line 4}} - 1.000000$ 10^6
- c. Y PIPA S.F. Error = $\frac{2 \text{ local } y}{G_y - G_g} - 1.000000$ 10^6
- d. Z PIPA S.F. Error = $\frac{2 \text{ local } z}{\text{line 7} - \text{line 9}} - 1.000000$ 10^6

The PIPA S.F. Error shall not exceed ± 2000 PPM

| TABLE XXII | | Local Gravity values |
|------------|--|--------------------------------------|
| Location | | Local Gravity (cm/sec ²) |
| NAA | | 979.56 |
| MBC | | 979.29 |
| KSC | | 979.24 |

6.2.16.10.6 Compute the PIPA Bias in cm/sec² from the values recorded in 6.2.16.10.1 and record in Table X_1 .

- a. PIPA Bias = $\frac{+PIPAG + (-PIPAG)}{2}$
- b. X PIPA Bias = $\frac{\text{line 2} + \text{line 4}}{2}$
- c. Y PIPA Bias = $\frac{G_y + G_g}{2}$
- d. Z PIPA Bias = $\frac{\text{line 7} + \text{line 9}}{2}$

The PIPA Bias shall not exceed ± 2.28 cm/sec².

6.2.16.10.7 Calculate NBD, ADSRA, and ADIA from the values recorded in 6.2.16.10.1 and record in Table X_1 .

- a. NBDX = - (line 6) =
- NBDX = - (line 1) =
- NBDZ = line 3 =
- NBD shall not exceed ± 15 mru.

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6.2.17 EXT-NB-Fine Alignment Test

6.2.17.1 Deleted: Master is alignment of G/N before proceeding.

6.2.17.2 The G/N shall have had OPERATE power applied for a minimum of 1 hour.

6.2.17.3 Set the G/N POWER-OPTICS switch to OPTICS. Verify that +28 VDC OPTICS OPERATE BUS (CG 1530) is +28.0±3.0 VDC. Verify that the OPTX 28V 800 cps 1% 0° ph (CG 1211) and OPTX 28V 800 cps 5% -90° ph (CG 1212) are not flashing on the CRT.

6.2.17.4 Deleted: ENTER G/NOUN 10 into K-148. Press the ENTER pushbutton. Enter 00000 into K-148. Press the ENTER pushbutton. Record R1 = AAAAA.

If the recorded value is within any of the sets of limits given in Table 1 proceed with the test. If the recorded value is NOT within any of the sets of limits wait 30 minutes and then repeat this step.

TABLE 1

| MIN VALUE | AAAAA | MAX VALUE |
|-----------|-------|-----------|
| 00000 | AAAAA | 06242 |
| 04000 | AAAAA | 07242 |
| 10000 | AAAAA | 13242 |
| 14000 | AAAAA | 17242 |
| 20000 | AAAAA | 23242 |
| 24000 | AAAAA | 27242 |
| 30000 | AAAAA | 33242 |
| 34000 | AAAAA | 37242 |

6.2.17.5 On the G/N Indicator Control Panel set the following switches to the position indicated.

- a. OPTICS TEL TRUN to SLAVE to EXT
- b. OPTICS COUPLING to DIRECT
- c. OPTICS SPEED to LO
- d. OPTICS MODE to MAN
- e. OPTICS ZERO to ZERO

6.2.17.6 Deleted: Following line Be DELAY:

f. VERT G/NOUN 00, ENTER
g. 00000, ENTER

Record R2 = 00000

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- 6.2.17.18 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- a. R1 = +xxx.xx (Target 2 Azimuth)
 - b. R2 = xxx.xxx (Target 2 Elevation)
 - c. R3 = 00002
- 6.2.17.19 If the data displayed is correct proceed to 6.2.17.22. If R1 and R2 do not contain the correct azimuth and elevation for Target 2, correct the data by entering the following sequence into the DSKY.
- a. VERB 24, ENTER
 - b. +xxx.xx000.10 degrees, ENTER (Target 2 Azimuth)
 - c. xxx.xxx00.010 degrees, ENTER (Target 2 Elevation)
- 6.2.17.20 Set the OPTICS ZERO switch to OFF. Enter VERB 33, ENTER into the DSKY.
- 6.2.17.21 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00001, on the DSKY set the OPTICS MODE switch on the G&N Indicator Control Panel to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.
- 6.2.17.22 Using the Optics Hand Controller, align the SXT S&LOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.23 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement of the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.24 Using the Optics Hand Controller, align the SXT S&LOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- NOTE: The following two MARKS must be performed as quickly as possible. In no case shall the time between the first and second MARK exceed two minutes.
- 6.2.17.25 After 20 seconds observe the DSKY for VERB 51 and NOUN 70 flashing and R1 = 00001. Set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.

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6.2.18.5 To change the launch azimuth perform the following:

- VERB 78, ENTER
- R1 displays present launch azimuth
- To change launch azimuth enter
VERB 21, ENTER
+XXX.XX ENTER (New launch azimuth)

NOTE: Using the beginning of row. 02 as t_0 , initial start time, read record CPUX, CPUY, and CPUZ every 15 minutes for 120 min and every 5 minutes for the next 60 minutes.

6.2.18.6 When PROG display changes to 02 record time as T_0 . Observe the PROG display change to 03 after approximately 90 seconds. Approximately 5 minutes later observe the PROGRAM display change to 03. When PROG display changes to 03 record time as T_0 .

6.2.18.7 Gyro Compassing Stability

6.2.18.7.1 120 minutes after T_0 record the Outer, Inner and Middle CDU Gimbal angles from the CRT.

6.2.18.7.2 Repeat above step every 5 minutes for the next 120 minutes.

6.2.18.7.3 The peak to peak spread of the outer gimbal angle shall not exceed 0.12° .

6.2.18.7.4 The peak to peak spread of the Inner and Middle gimbal angles shall not exceed 0.06° .

6.2.18.8 Gyro Compassing Accuracy

6.2.18.8.1 After 240 minutes from T_0 set the OPTICS ZERO switch on the G&N Indicator to ZERO.

6.2.18.8.2 Deleted following into the DESPY:

| | | |
|---------|---------|-------------------------|
| VERB 21 | NCUN 00 | ENTER |
| 02553 | | ENTER |
| +XXX.XX | +000.01 | ENTER (Target No. 1 AZ) |
| | | ENTER |
| 02554 | | ENTER |
| +00.000 | | ENTER (Target No. 1 EL) |
| | | ENTER |
| 02555 | | ENTER |
| | +000.01 | ENTER (Target No. 2 AZ) |
| | | ENTER |
| 02556 | | ENTER |
| +00.000 | | ENTER (Target No. 2 EL) |

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NOTE: Read the following 10 steps before proceeding. These are time critical steps and must be performed as rapidly as possible

- 6.2.18.8.3 Enter VERB 65, ENTER into DSKY.
Observe the PROGRAM display on the DSKY change to 03.
- 6.2.18.8.4 When VERB 06 NOUN 41 flashed on the DSKY, insure that R1 and R2 display Target 1 azimuth and elevation.
 - a. R1 = +XXX.XX (Target 1 azimuth)
 - b. R2 = +XX.XXX (Target 1 elevation)
 - c. R3 = 00001
- 6.2.18.8.5 Verify the data appearing in R1 and R2 and if correct, proceed. If not correct, perform the following sequence:
 - a. VERB 24, ENTER
 - b. +XXX.XX, ENTER (Target 1 azimuth)
 - c. +XX.XXX, ENTER (Target 1 elevation)
- 6.2.18.8.6 After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY.
- 6.2.18.8.7 When VERB 06 NOUN 41 flashes on the DSKY, insure that R1 and R2 display Target 2 azimuth and elevation.
 - a. R1 = XXX.XX (Target 2 azimuth)
 - b. R2 = XX.XXX (Target 2 elevation)
 - c. R3 = 00002
- 6.2.18.8.8 Verify the data appearing in R1 and R2 and if correct, perform the following sequence:
 - a. VERB 24, ENTER
 - b. +XXX.XX, ENTER (Target 2 azimuth)
 - c. +XX.XXX, ENTER (Target 2 elevation)
- 6.2.18.8.9 After the correct readings for R1 and R2 are verified enter VERB 33, ENTER into the DSKY.
- 6.2.18.8.10 Using the Optics Hand Controller, align the SXT StLOS to Target 1 and press MARK pushbutton. If satisfied that the MARK was good, press the ENTER push button. If not satisfied with MARK, press the MARK REJECT pushbutton and repeat this step.

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6.2.9.24.17 When the tape reader stops read and record the fractional Trunnion Optics CDU Drive Rate display on the CRT DSKY Row 1 (.XXXXX deg/sec).

6.2.9.24.18 The Trunnion Optics CDU Drive Rate (Trunnion Rate = R1 (whole). R1 (fractional) deg/sec) shall be 1.83 ± 0.5 deg/sec. Wait 50 sec before proceeding.

6.2.9.24.19 If optics testing will not continue, set the G/N POWER OPTICS switch on the LEB Lighting Control Panel to OFF.

Change 7 The following procedure replaces paragraph 6.2.15 when COLOSSUS flight ropes are installed in the S/C.

6.2.15 IRIG Scale Factor Test.

Test will be run with E-Memory program. Program to be put on K-START tape. Procedure to be supplied when available.

Change 8 The following procedure replaces paragraph 6.2.16 when COLOSSUS flight ropes are installed in the S/C.

6.2.16 IMU Performance test. A reference data sheet is provided at the end of this section to aid in data reduction.

6.2.16.1 Deleted. Refer to paragraph 6.2.5.3 before proceeding.

6.2.16.2 Deleted. Enter the following:

000001 000000 000000
000003 000000 000000

Record CRT DSKY Row 1 Indication as AAAA and the time of day.

6.2.16.3 Deleted. Enter the following:

000001 000000 000000
000003 000000 000000
AAAA 000000 000000
000006 000000 000000
000003 000000 000000

Record CRT DSKY Row 1 Indication as 000000.

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- 6.2.16.4 Deleted.** the following calculations:
- $\frac{BTBPA \times 0.12}{3600} = 0000.C$ (Contents first of high order scalar register)
 - $23.4 - 0000.C = DDTT.D$ hours.
 - $TTDT.D + \text{present time of day} = \text{time of day at which high order scalar register will overflow.}$
- 6.2.16.5 Deleted.** time of day is within 12 minutes of that calculated in 6.2.16.4.c when about to perform any of the following paragraphs, wait until that time calculated in 6.2.16.4.c has passed and proceed.
- 6.2.17.4.6
 - 6.2.18.9.0
 - 6.2.19.13.0
 - 6.2.20.17.0
 - 6.2.21.12.4
 - 6.2.22.18.4
- 6.2.16.6 Deleted**
- 6.2.16.7 E-Memory Load.**
- 6.2.16.7.1 Start tape reader.**
- 6.2.16.7.2 When tape reader stops enter the following on K-148:**
- | | | |
|---------|---------|------|
| VERB 06 | NOUN 01 | ENTR |
| XXXXX | | ENTR |
- NOTE: XXXXX is the third last location of the E-Memory Program load. (To be specified when available).
- 6.2.16.7.3 Verify CRT DSKY display the following:**
- | | |
|-------|-------|
| Row 1 | 00033 |
| Row 2 | 00000 |
| Row 3 | 00000 |
- 6.2.16.8 Position 1 Stable Member Matrix Load.**
- 6.2.16.8.1 Start tape reader.** Member Matrix Load.
- 6.2.16.8.2 When tape reader stops enter the following on K-148:**
- | | |
|---------|------|
| VERB 92 | ENTR |
|---------|------|
- 6.2.16.8.3 Observe VERB 21 NOUN 01 flashing.** On K-148 enter the following:
- +XXX.XX ENTR (Correct navigation base azimuth ± 0.50 deg.)
- +28.516 ENTR (Correct test site latitude.)
- Verify values in R1 and R2 are correct.

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- f. CG 3118 SXT Trunnion Servo Error in phase
- g. CG 3144 SXT Shaft MTR control winding
- h. CG 3155 SXT Trunnion MTR control winding

- 6.2.10.6 Push the Optics Hand Controller to the right, driving the SXT Shaft until R1 on the CRT indicates $+180 \pm 1^\circ$. Push the Optics Hand Controller up, driving the SXT Trunnion until R2 on the CRT indicates $+75 \pm 1^\circ$.
- 6.2.10.7 Start the Analog Recorders and set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO.
- 6.2.10.8 Monitor the Analog Recorders until all signals return to null. Stop the Analog Recorders. The elapsed time between the initial and final SXT Shaft and Trunnion Tach output nulls shall be less than 15 seconds. The peak magnitude of the SXT Shaft (CG 3140) and Trunnion (CG 3150) Tach Outputs shall be $-3.3 \pm 1.3V$ rms. The peak magnitude of the SCT Shaft Tach Output (CG 3160) shall be $+3.3 \pm 1.3V$ rms. The peak magnitude of the SCT Trunnion Tach Output (CG 3170) shall be $0.85 \pm 0.34V$ rms. The SXT SHAFT (CG 3117) and TRUNNION (CG 3118) Servo Error in Phase measurements shall each have a maximum magnitude of 2 VRMS. The peak magnitude of the SXT SHAFT (CG 3117) and TRUNNION (CG 3118) MTR Control Winding measurements shall be $0.1 \pm 0.05V$ rms.
- 6.2.10.9 Record R1 and R2 on the CRT. The data displayed shall be as follows:
 - a. R1 = $000.00 + 000.02, -0.03$
 - b. R2 = $00.000 + 00.006, -0.007$
- 6.2.10.10 Record the Telescope Panel Angle Counter indications. The Shaft Angle shall be 0.0 ± 0.11 degrees. The Trunnion Angle shall be 0.0 ± 0.22 degrees.
- 6.2.10.11 Set the OPTICS MODE switch on the G&N Indicator Control Panel to MAN. Set the G/N Power Optics switch on the LEB Lighting Control Panel to OFF.

OPTICS BACKUP MODE TEST

- 6.2.10.12 Insert the Inflight Tool (V36601405) into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eye-piece while turning the tool until the TPAC reads $+5^\circ$. Remove the tool from the trunnion tool input.

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6.2.10.13 Insert the Inflight Tool (V36601405) into the Shaft Tool Input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to -3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool.

6.2.10.14 Insert the Inflight Tool (V36601405) into the Trunnion Tool input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool.

6.2.11 OPTICS Coordinate Transformation Control Test.

6.2.11.1 Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.

NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding.

INITIALIZATION

6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.

- TELESCOPE TRUNNION to SLAVE to SKT
- CONTROLLER COUPLING to DIRECT
- CONTROLLER SPEED to HI
- OPTICS MODE to MAN

6.2.11.3 Enter the following into the K-Start: **VERB-16- NOUN-51- ENTR**

6.2.11.4 Set the OPTICS MODE switch on the G&N Panel to ZERO.

Wait 15 seconds. Retare the OPTICS MODE switch to MAN.

6.2.11.5 Set up the analog recorders to monitor the following:

6.2.11.6 Monitor the SCT 3178 SOT Trunnion Tachometer Output.

6.2.11.7

6.2.11.8

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- 6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until R1 = +225.00 and R2 = +10.000 on the CRT and the DSKY's.
- 6.2.11.7 Set the CONTROLLER COUPLING switch on the G&N Panel to RSLV and the CONTROLLER SPEED switch to MED.
- 6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.
- 6.2.11.9 Record time.. Quickly displace the OPTICS CONTROL STICK 45 ± 10 degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at 45 ± 10 degrees. When target leaves the SCT upper right field of view press MARK pushbutton. The PROG alarm light shall light.
- 6.2.11.10 From the uplink file tape, the compressed data tape, or the PCM tape request a data reduction of the shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) and the PROG alarm discrete for the period during which the OPTICS CONTROL STICK was being displaced above. The shaft CDU angle shall be 225 ± 10.00 degrees at the time the PROG alarm occurred. The elapsed time from time of OPTICS CONTROL STICK displacement to the time the PROG alarm discrete is obtained shall be 19 to 32 seconds.
- CSC AMPLIFIER SHAFT AND TRUNNION DRIVE TEST
- 6.2.11.11 Set the CONTROLLER COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the Optics until R1 = +225.00 and R2 = +10.000. Set the CONTROLLER COUPLING switch to RSLV.
- 6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.
- 6.2.11.13 Set the CONTROLLER COUPLING switch on the G&N Panel to DIRECT. Set the OPTICS MODE switch to ZERO. After 15 seconds, return the switch to MAN.

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Change 14

Replace section 6.2.12 with the following:

6.2.12 OPTICS FUNCTIONAL TEST

6.2.12.1 Deleted.

6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:

- a. +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8±8 VDC. Record the indication on the CRT.
- b. CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.
- c. CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT.

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6.2.13.9 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the OPTICS CONTROLLER SPEED switch to MED.

NOTE: Read and understand 6.2.13.10 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.

6.2.13.10 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.

Record the EXT TRUN MTR control winding (CG 3155) signal on the CRT while slewing the optics. The voltage shall be +0.25 to 2.00 VRMS.

6.2.13.11 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU registers (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Trunnion slew rate shall be 1.0 ± 0.2 deg/sec.

SHAFT SLEW RATE - MED SPEED

6.2.13.12 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set OPTICS MODE switch to MAN.

NOTE: Read and understand 6.2.13.13 before proceeding. Do not hold control stick at the right limit for more than 20 seconds.

6.2.13.13 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.

Record the EXT SHAFT MTR control winding (CG 3145) signal on the CRT while slewing the optics. The voltage shall be +0.25 to 2.00 VRMS.

6.2.13.14 Perform the following calculations:

From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) for the 12 second period during which the rate test was being performed.

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Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Shaft slew rate shall be 2.0 ± 0.4 deg/sec.

TRUNNION SLEW RATE - LO SPEED

6.2.13.15 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the CONTROLLER SPEED switch to LO.

6.2.13.15.1 During the Trunnion Slew Rate Test monitor and verify the following signals:

| | |
|---------------------------------------|------------------------|
| Signal | Requirement |
| a. TRUNNION CDU FINE ERROR (CG 3001), | FQ ± 0.07 VRMS MAX |

NOTE: Read and understand 6.2.13.16 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.

6.2.13.16 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.

6.2.13.17 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the slew rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Trunnion Slew Rate shall be 0.10 ± 0.02 deg/sec.

SHAFT SLEW RATE - LO SPEED

6.2.13.18 Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.

6.2.13.18.1 During the Shaft Slew Rate test monitor and verify the following signal:

| | |
|-----------------------------------|------------------------|
| Signal | Requirement |
| a. SHAFT CDU FINE ERROR (CG 3021) | FQ ± 0.07 VRMS MAX |

NOTE: Read and understand 6.2.13.19 before proceeding. Do not hold control stick at right limit for more than 20 seconds.

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6.2.13.19 Record time. Push and hold the Optics Control stick to its right limit. After approximately 12 seconds release the control stick.

6.2.13.20 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the slew rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Shaft Slew Rate shall be 0.20 \pm 0.04 deg/sec.

OPTICS HAND CONTROLLER DRIFT RATE CHECK - LO SPEED

6.2.13.21 Set the OPTICS MODE switch to zero. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Record time. Wait 60 seconds.

6.2.13.22 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion and Shaft CDU registers (addresses 35 and 36 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 60 second period during which the drift rate test was being performed.

Calculate the drift rates by dividing the Δ CDU angle by the elapsed time.

The Trunnion drift rate shall be less than .0167 deg/sec.

The Shaft drift rate shall be less than .0333 deg/sec.

6.2.13.23 If OPTICS testing will not continue, set the G/N Power-Optics switch on the LEB Lighting Control Panel to OFF.

Change 16 Replace Paragraph 6.2.17.5 with the following:

6.2.17.5 On the G&N Indicator Control Panel set the following switches to the position indicated.

- TELESCOPE TRUNNION to SLAVE to SXT
- CONTROLLER COUPLING to DIRECT
- CONTROLLER SPEED to LO
- OPTICS MODE to ZERO.

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Change 17 Replace paragraph 6.2.17.20 with the following:

6.2.17.20 Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN. Enter VERB 33, ENTER into the DSKY.

Change 18 Replace paragraphs 6.2.18.8.11, 6.2.18.8.12 and 6.2.18.8.14 with the following:

6.2.18.8.11 Set the CONTROLLER SPEED switch to HI. Using the Optics Hand Controller, drive the SXT S&LOS to the approximate position of Target 2.

6.2.18.8.12 Set the CONTROLLER SPEED switch to LO. Using the Optics Hand Controller, align the SXT S&LOS to Target 2 and press the MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied, press the MARK REJECT pushbutton and repeat this step.

6.2.18.8.14 Enter VERB 34, ENTER into the DSKY. Observe the PROGRAM display change to 02. Set the Optics Mode Switch on the G&N Indicator Control Panel to ZERO.

Change 19 Replace paragraphs 6.2.20.3.2, 6.2.20.3.22, and 6.2.20.3.29 and replace with the following:

6.2.20.3.2 Set the OPTICS MODE selector on the Indicator Control panel to MAN.

6.2.20.3.22 Set the OPTICS CONTROLLER SPEED switch on the Indicator Control Panel to HI.

6.2.20.3.29 Set the OPTICS MODE Switch on the Indicator Control panel to ZERO for 30 seconds then return to MAN.

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POST INSTALLATION CHECKOUT PROCESS
 SPECIFICATION FOR THE APOLLO GUIDANCE &
 NAVIGATION SYSTEM BLOCK II-KSC

Record of Revisions

| Date | Revision Letter | TDRR No. | Pages Revised | Approval |
|---------|-----------------|----------|--|----------|
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This specification consists of page 1 to 174 inclusive.

| APPROVALS | NASA/NSC | Other | Other |
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| | | <i>[Signature]</i> | <i>[Signature]</i> |

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1. INTRODUCTION

1.1 The individual Spacecraft (SC) installed Guidance and Navigation (G&N) System to be checked out per this process specification shall consist of one of each of the following major assemblies: The applicable part numbers shall be determined by drawing No. 2014999.

1 - Optical Unit Assembly

1 - Navigation Base Assembly, Block II

1 - Inertial Measurement Unit (IMU) & PIPA Elect. Assy.

1 - Power and Servo Assembly (PSA)

1 - Apollo Guidance Computer Group

1 - G&N Interconnect Harness Assembly

1 - Signal Conditioner Assembly

1 - Display and Control Group (D & C)

1 - Coupling Data Unit

1.2 The G&N System herein shall be identified as a Block II system. The computer contains the program flight ropes in the core rope memory. The test requirements herein are based on Sundisk Rev. 282.

2. SCOPE

2.1 This specification outlines the checkout requirements for the G&N System installed in the Apollo Command Module Spacecrafts and tested in the VAB, SBOB, or on the PAD.

2.2 This document is to be used as technical support for all Block II G&N System test documentation for Command Module spacecraft testing. This document shall be amended by addendum to support applicable hardware, mission or program differences.

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| | | |
| 5.1.2.4 | <p>Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N System as nonconforming. The normal test sequence may be continued on determination of the cause of the nonconformance if not detrimental to the G&N System or other interfacing subsystems. This determination shall have the concurrence of the G&N contractor test team. All nonconformance shall be investigated and cleared by waiver (FNN), correction of test specification, or hardware replacement. The suspected malfunctioning hardware shall be removed and returned to the laboratory. Only a flight certified replaceable unit shall be installed in the G&N System.</p> | |
| 5.1.2.5 | <p>The G&N System shall be operating in STANDBY mode with CMC power applied for a minimum of two hours prior to torquing of inertial components. In the event STANDBY or CMC power is interrupted, an equivalent time period shall be allowed when power is restored before transfer to the OPERATE mode, except that when the interval of interruption exceeds two hours, a two-hour warmup period shall be mandatory. Exceptions to the above are noted in 6.2.5.2.</p> | |
| 5.1.2.6 | <p>The interruption of +28 VDC power to the G&N System through the Main A and Main B power busses shall be cause for the Command Module G&N System operator to immediately initiate the Emergency shutdown procedure (6.1.4) to preclude damage to the G&N System.</p> | |
| 5.1.2.7 | <p>The SCT and SXT eyepieces shall be stowed whenever the instruments are not in use to preclude damage to them. It shall be necessary to install the eyepieces when testing requires use of the instrument.</p> | |
| 5.1.2.8 | <p>To preserve the operational life of the components of the MDC and LEB DEKY's, the monitor routines shall be used only when required by test procedure or trouble shooting. Such routines shall be terminated as quickly as possible in the test flow. Computer routines which cause the DEKY display to flash (either requesting data or displaying data) shall also be terminated as quickly as possible.</p> | |
| 5.1.2.9 | <p>To reduce the possibility of the optics drifting into the stops, place the optics in the ZERO mode whenever the optics is to be on and not used for any appreciable time.</p> | |
| 5.1.2.10 | <p>Avoid repeated slewing of SXT Shaft and Trunnion into the mechanical stops.</p> | |
| 5.1.2.11 | <p>Prior to performing a ZERO OPTICS, the SXT Trunnion shall be carefully slewed to within +10 degrees of zero as indicated by the TPAC (Telescope Trunnion slaved to SXT). In no event shall the OPTICS be ZEROED from angles greater than +10 degrees on Trunnion.</p> | |

5.2 Standard Environmental Conditions

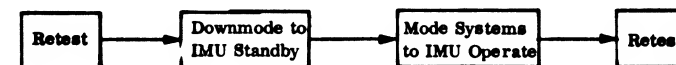
- 5.2.1** The G&N System when installed in the Command Module shall be tested in an environment in accordance with ICD MH01-1348-416. Dust covers shall be installed on the EXT and SCT per ICD MH01-01350-116 when optics are not under test.
- 5.2.1.1** For periods of G&N Testing with the optical heads and the eyepieces of the SCT and EXT of the C/M G&N uncovered, or with the eyepieces removed, the environment shall meet at least the Class 100,000 particle size and count.
- 5.2.1.2** With the optical heads covered and the eyepieces installed or covered on the optical components (EXT, SCT), the ambient environment shall meet the following conditions for particle size and count. No more than 1,400 particles 5.0 microns or larger per cubic foot.
- 5.2.2** The APOLLO G&N System shall interface with a qualified ECS distribution system which shall supply coolant fluid during STANDBY and OPERATE control modes with flow rates and inlet temperatures as specified in ICD MH01-01349-416.
- 5.3 Test Equipment Tolerances**
- 5.3.1** Measurements and tolerances are specifications stated herein are basic G&N System performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. PSAAM and Signal Conditioner stability uncertainties are included in Appendix I.

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5.4.2 Failure of the D criteria for IRIG and PIPA parameters.

5.4.2.1 If D_1 , D_2 , or D_3 exceeds its maximum value as specified in Table D, Paragraph 6.2.16.10.8 for any IRIG or PIPA, a retest sequence shall be initiated as indicated below:



RETEST SEQUENCE

The retest sequence shall be performed using the paragraphs indicated in Table I corresponding to the out-of-spec parameters. Table 2 indicates the test positions and other isolated parameters that must be recalculated and qualified.

If D_1 , D_2 , or D_3 exceeds its maximum value after the retest sequence is completed, the requirements of 5.4.2.2 (IRIG) or 5.4.2.3 (PIPA) shall apply. If D_1 , D_2 , and D_3 are within tolerances specified in Table D after the retest sequence is completed, the original out-of-tolerance D terms calculated in paragraph 6.2.16.10.8 shall be exonerated.

5.4.2.2 IRIG stability requirements.

5.4.2.2.1 Failure to be within the maximum values for D_1 or D_2 or D_3 after the retest sequence shall constitute failure of the unit.

5.4.2.3 PIPA stability requirements.

5.4.2.3.1 Failure to be within the maximum limits of D_1 or D_2 or D_3 after the retest sequence constitute failure of the unit.

5.4.2.3.2 If authority has been obtained to degauss a PIPA, then data taken prior to the degaussing of that PIPA, shall not be used in the future to calculate stability terms. After degaussing, the retest sequence of Paragraph 5.4.2.1 must be performed.

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| 5.10 | | |
| The test equipment listed in paragraph 4.1 shall be connected and ready for operation before the tests of this specification are initiated. | | |
| 5.11 | | |
| Data Records | | |
| 5.11.1 | | |
| All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance readings shall be recorded and flagged by appropriate symbols. | | |
| 5.11.1.1 | | |
| All test data obtained while demonstrating the requirements of this document shall be permanently recorded and forwarded to the next receiving agency. | | |
| 5.11.1.2 | | |
| A record of the amount of time each of the four prime power busses are on shall be kept and forwarded to the next receiving agency. | | |
| 5.12 | | |
| Interface | | |
| 5.12.1 | | |
| The APOLLO G&N System shall interface with accepted ECS and EPS distribution systems for power and environment control purposes and with the SCS or SCS substitute system for signal interface in accordance with the applicable ICD's. | | |
| 5.13 | | |
| General System Operating characteristics. | | |
| 5.13.1 | | |
| The program does not automatically display computer error codes when a PROG alarm occurs. If error code is desired enter the following on K-148 and then observe the DSKY display. | | |
| VERB 06 NOUN 09 ENTR | | |
| R1 = FAILREG | | |
| R2 = FAILREG +1 | | |
| R3 = FAILREG+2 | | |
| 5.13.2 | | |
| The DSKY "NO ATT" lamp illuminates any time the system is in the Coarse Align Mode, IMU Cage, or during turn on. | | |
| 5.13.3 | | |
| Tracker Fail lamp may light after optics power turn on. Press the Error Reset to extinguish. | | |
| 5.13.4 | | |
| The CMC warning light may come on for approximately 30 seconds when +28 VDC CMC Operate Power is applied; if the MASTER ALARM light illuminates, push to reset. | | |
| 5.13.5 | | |
| When coming out of AGC STBY, if the Standby lamp does not extinguish when the PRO pushbutton is pressed, repeatedly press the PRO pushbutton until the Standby lamp does extinguish. Record the number of times it was necessary to press the STBY pushbutton. No more than three depressions of the PRO pushbutton shall be required to turn the STBY lamp off. | | |

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6.2.2.3 CAUTION and STATUS Displays

6.2.2.3.1 Enter VERB 35, ENTR, into LEB CMC DSKY.

6.2.2.3.2 The following MDC and LEB CMC DSKY displays shall illuminate for approximately 5 seconds.

- a. UPLINK ACTY
- b. NO ATT
- c. STBY
- d. KEY REL Flashing
- e. TEMP
- f. GIMBAL LOCK
- g. PROG
- h. RESTART
- i. TRACKER
- j. OPR ERROR Flashing
- k. COMP ACTY
- l. PROGRAM 88
- m. VERB 88 NOUN 88 flashing
- n. +88888 in R1, R2 and R3
- o. PGNCB, CMC, 188 WARNING lights (CMC shall remain illuminated for 15±5 seconds).

After indications a. through m. go out, +88888 shall remain in R1, R2, R3.

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- 6.2.2.4.9 Repeat 6.2.2.4.1 through 6.2.2.4.8 using the MDC CMC DSKY.
- 6.2.2.5 Uplink and Downlink Checks.
- 6.2.2.5.1 Enter VERB 36 into K148. Press the ENTER pushbutton, then press ERROR RESET pushbutton.
- 6.2.2.5.2 Enter the following sequence into K148. Press the ENTER pushbutton after each entry.
- VERB 25 NOUN 01 ENTER
 - 02100, ENTER
 - 00000, ENTER
 - 77777, ENTER
 - 07254, ENTER
 - VERB 05 NOUN 01, ENTER
 - 02100, ENTER
- 6.2.2.5.3 CMC Registers R1, R2, and R3 display on the CRT shall indicate 00000, 77777, and 07254, respectively.
- 6.2.2.5.4 Set/Verify that the UP TLM switch on the Main Display Panel is set to ACCEPT and that the UP TLM switch on the G&N Indicator Control Panel is set to BLOCK.
- 6.2.2.5.5 Execute the Block Uplink Override R-START to enable data to be sent via K-START. On K-148 insert VERB. Verify that the VERB indications on the DSKY and CRT does not change.
- 6.2.2.5.6 Set the UP TLM switch on the G&N Indicator Control Panel to ACCEPT. Verify that the BLOCK UPLINK discrete is OFF.
- 6.2.2.5.7 On K-148 insert VERB 01. Verify that the VERB indication on the DSKY and CRT is 01.
- 6.2.2.5.8 Set the UP TLM switch on the MAIN DISPLAY Panel to BLOCK. Verify that the BLOCK UPLINK discrete is ON.
- 6.2.2.5.9 On K-148 insert VERB. Verify VERB indication on the DSKY and CRT does not change.
- 6.2.2.5.10 Set the UP TLM switch on the MAIN DISPLAY Panel to ACCEPT. Verify that the BLOCK UPLINK discrete is OFF. Remove the Block Uplink Override R-START.
- 6.2.2.5.11 On K-148 insert VERB 36. Press the ENTER pushbutton.

- 6.2.3.1.6 Immediately begin monitoring the following measurements.
- The IMU Operate Power is $+28.8 \pm 3$ VDC (CG 1500). Verify on CRT.
 - On the recorders, verify that oscillations are not sustained and that a null is achieved within 10 seconds of power application in 6.2.3.1.5. on the following measurements:

CG 2112, IG IX Resolver Output Sin
CG 2142, MG IX Resolver Output Sin
CG 2172, OG IX Resolver Output Sin
 - Deleted.
 - On the CRT, verify the absence of the +120 VDC PIPA supply (CG 1040) for a period of 90+10 seconds following power application in 6.2.3.1.5. Verify PIPA fail discrete is present during this period. After approximately 100 seconds, the voltage shall read $+120 \pm 6$ Vdc.
 - Stop the analog recorders.
- 6.2.3.1.7 Insure that the following alarm lamps are not lighted on G&N LEB Display Panel.
- CMC Warning
 - ISS Warning
 - PGNS Caution
- 6.2.3.1.8 Verify that the PROGRAM ALARM lamp on the DSKY's does not light.
- 6.2.3.1.9 The OG, IG, and MG CDU angles shall be 00000+00150. Verify on CRT.
- 6.2.3.1.10 Enter the following into K-148:
- VERB 41 NOUN 20, ENTER
 - +00000, ENTER
 - +00000, ENTER
 - +00000, ENTER
- 6.2.3.1.11 Verify that the following secondary power supply voltages are not flashing on the CRT display.

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- 6.2.3.2.3 Verify the following secondary power supply voltages on the CRT are not flashing:
- CG 1211 OPTX 28V 800 CPS 1 pct 0 ph
CG 1212 OPTX 800 CPS 5 pct-90 ph
- 6.2.3.2.3.1 Set/verify OPTICS MODE on the G&N Indicator Control Panel to MAN.
- 6.2.3.2.3.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Panel to ZERO.
- 6.2.3.3 IMU Cage Test
- 6.2.3.3.1 Enter the following into the DSKY:
- a. VERB 40 NOUN 20, ENTER (wait 3 seconds)
b. VERB 41 NOUN 20, ENTER
c. +00200, ENTER
d. +00200, ENTER
e. +00200, ENTER
- Observe that the NO ATT lamps on the DSKY's light and that CDUX, CDUY, CDUZ on the CRT indicate approximately +00200.
- 6.2.3.3.2 Set up the Analog Recorder to monitor the following signals:
- a. IG 1X Resolver Output Sine (CG 2112)
b. MG 1X Resolver Output Sine (CG 2142)
c. OG 1X Resolver Output Sine (CG 2172)
- Start the Analog Recorders.
- 6.2.3.3.3 On MDC panel 1, press and hold the IMU CAGE switch in the CAGE position. On the Analog Recorder, verify that the 1X Sine signals (CG 2112, CG 2142, and CG 2172) null out at 0.5V rms or less.
- 6.2.3.3.4 Release the IMU CAGE switch. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Sustained oscillations shall be cause for immediate removal of IMU OPERATE power.
- 6.2.3.3.5 On the CRT verify that CDUX, CDUY and CDUZ are all between +00150 and +35850.
- 6.2.3.3.6 Stop the Analog Recorders.
- 6.2.4 G&N System Power Supplies Test

- 6.2.4.6 The following values shall be measured with the guidance reference clock synchronizing input pulse. Record the voltage indicated on the CRT.
- IMU 28V, 800 CPS 1% 0 deg voltage shall be 28.0 ± 0.6 VAC (CG 1201).
 - IMU 28V, 800 CPS, 5% PHA - 90 deg. voltage shall be 28.0 ± 1.4 VAC (CG 1202).
 - IMU 28V, 800 CPS, 5% PHB 0 deg. voltage shall be 28.0 ± 2.1 VAC (CG 1203).
 - Optics 28V, 800 CPS 1% 0 deg voltage shall be 28.0 ± 0.6 VAC (CG 1211).
 - Optics 28V, 800 CPS 5% - 90 deg voltage shall be 28.0 ± 1.5 VAC (CG 1212).
 - PH Diff IMU 5% 0 deg. -90 deg. (CG 1207) phase difference shall be $-90^\circ \pm 10^\circ$.
 - PH Diff Optics 1% IMU 1% (CG 1220) phase difference shall be $0^\circ \pm 10^\circ$.
- 6.2.4.7 Record the voltages indicated on the CRT for the following power supplies:
- The +14 VDC CMC Power Supply output voltage shall be $+14.0 \pm 0.4$ VDC (CG 1020).
 - The +4 VDC CMC Power Supply output voltage shall be $+4.0 \pm 0.2$ VDC (CG 1030).
 - The +4 VDC CDU Power Supply output voltage shall be $+4.0 \pm 0.2$ VDC (CG 1070).
 - The +2.50 VDC TM BIAS SUPPLY output voltage shall be $+2.50 \pm 0.05$ VDC (CG 1110).
- 6.2.4.8 Record the CRT indications for the following measurements:
- The 28V, 3200 CPS Power Supply feedback output voltage shall be 28.6 ± 0.6 V RMS (CG 1331).
 - The phase difference between the 3.2 Kc supply and CMC sync shall be $0^\circ \pm 10^\circ$ (CG 1336).
 - The +14 VDC CMC Power Supply rms noise shall be less than 0.2 vrms (CG 1021).
 - The +4 VDC CMC Power Supply rms noise shall be less than 0.2 vrms (CG 1031).
- 6.2.4.8.1 Enter the following the the K-Start:
- ```

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+09000 ENTR
Wait 15 seconds.

```
- 6.2.4.9 Set/Verify the following circuit breakers and switches on the Right Hand Circuit Breaker Panel and LEB:
- G/N POWER-OPTICS to OFF
  - OPTICS MN B to ON (pushed in) and OPTICS MN A to OFF (pulled out)
  - G/N POWER - IMU to OFF
  - IMU MN B to ON (pushed in) and IMU MN A to OFF (pulled out).
  - IMU HTR MN A to OFF (pulled out)
  - G/N - POWER to OFF
  - COMPUTER MN B to ON (pushed in) and COMPUTER MN A to OFF (pulled out)



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| 6.2.4.10                                                                                                                                                                                                                                             |                 |      |
| Verify that the +28 VDC CMC OPERATE output voltage is +28.8±3 VDC (CG 1520).                                                                                                                                                                         |                 |      |
| 6.2.4.11                                                                                                                                                                                                                                             |                 |      |
| Set the G/N - POWER switch on the LEB to AC2. Set the IMU HTR MN B to ON (pushed in). Verify that the +28 VDC IMU STANDBY output voltage is +28.8±3 VDC (CG 1500).                                                                                   |                 |      |
| 6.2.4.12                                                                                                                                                                                                                                             |                 |      |
| Wait until 15 minutes have elapsed since setting G/N POWER - IMU to OFF in 6.2.4.9.c then set the G/N POWER - IMU to IMU. Verify that the +28 VDC IMU OPERATE output voltage is +28.8±3 VDC (CG 1500).                                               |                 |      |
| 6.2.4.13                                                                                                                                                                                                                                             |                 |      |
| Set the G/N POWER - OPTICS to OPTICS. Verify that the +28 VDC OPTX OPERATE output voltage is +28.8±3 VDC (CG 1530).                                                                                                                                  |                 |      |
| 6.2.4.14                                                                                                                                                                                                                                             |                 |      |
| Repeat 6.2.4.5 through 6.2.4.8.                                                                                                                                                                                                                      |                 |      |
| 6.2.4.15                                                                                                                                                                                                                                             |                 |      |
| Set the following circuit breakers to the position indicated:                                                                                                                                                                                        |                 |      |
| a. Set the COMPUTER MN A to ON (pushed in).                                                                                                                                                                                                          |                 |      |
| b. Set the IMU HTR MN A to ON (pushed in).                                                                                                                                                                                                           |                 |      |
| c. Set the IMU MN A to ON (pushed in).                                                                                                                                                                                                               |                 |      |
| d. Set the OPTICS MN A to ON (pushed in).                                                                                                                                                                                                            |                 |      |
| 6.2.4.16                                                                                                                                                                                                                                             |                 |      |
| Miscellaneous Checks - The following miscellaneous signals are required to supply data for system evaluation in the event of failure, or for trend analysis of system performance. Record the values displayed on the CRT for the following signals. |                 |      |
| a. CG 4300 CMC Temperature                                                                                                                                                                                                                           |                 |      |
| b. CG 6020 PIPA Calibration Module Temperature                                                                                                                                                                                                       |                 |      |
| c. CG 6021 IMU 800 CPS 5% Temperature                                                                                                                                                                                                                |                 |      |
| 6.2.4.17                                                                                                                                                                                                                                             |                 |      |
| Verify and record the following signals displayed on the CRT:                                                                                                                                                                                        |                 |      |
| a. +120 VDC PIPA SUP NOISE RMS shall be less than 1.5 VRMS (CG 1042).                                                                                                                                                                                |                 |      |
| b. +20 VDC PIPA SUP NOISE RMS shall be less than 1.0 VRMS (CG 1053)                                                                                                                                                                                  |                 |      |
| c. +4 VDC CDU SUP NOISE RMS shall be less than 0.2 VRMS (CG 1071).                                                                                                                                                                                   |                 |      |
| d. +28V IMU OPERATE BUS NOISE RMS shall be less than 1.0 VRMS (CG 1501)                                                                                                                                                                              |                 |      |
| e. +28V IMU STANDBY BUS NOISE RMS shall be less than 1.0 VRMS (CG 1511).                                                                                                                                                                             |                 |      |
| f. +28V CMC OPERATE BUS NOISE RMS shall be less than 2.0 VRMS (CG 1521)                                                                                                                                                                              |                 |      |
| g. +28V OPTX OPERATE BUS NOISE RMS shall be less than 2.0 VRMS (CG 1531).                                                                                                                                                                            |                 |      |
| 6.2.4.18                                                                                                                                                                                                                                             |                 |      |
| The noise peaks of the following signals are demonstrated on the event light when the peaks have a rise time between 2 and 50 usec and the peak voltage exceeds 5 volts.                                                                             |                 |      |

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- a. +14V CMC SUPPLY NOISE PEAKS (CG 1022)
- b. +4V CMC SUPPLY NOISE PEAKS (CG 1032)
- c. +120 VDC PIPA SUPPLY NOISE PEAKS (CG 1043)
- d. +4 VDC CDU SUPPLY NOISE PEAKS (CG 1072)
- e. +28V IMU OPERATE BUS NOISE PEAKS (CG 1502)
- f. +28V IMU STANDBY BUS NOISE PEAKS (CG 1512)
- g. +28V CMC OPERATE NOISE PEAKS (CG 1522)
- h. +28V OPTX OPERATE NOISE PEAKS (CG 1532)

6.2.4.19 If Optics Testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.

6.2.5 General Turn Off and Turn On Procedure

NOTE: The procedure shall be utilized any time after performing 6.2.1, Standby Power On Test and 6.2.3, Operate Power On Test to turn on or turn off the G&N Systems. Appropriate portions of this procedure will be referenced in other tests.

6.2.5.1 Turn Off Procedure.

CAUTION: This procedure must be performed in the sequence specified. Failure to adhere to this sequence may require calibration of the inertial components.

6.2.5.1.1 Enter the following sequence into the K-148.

- a. VERB 41 NOUN 20, ENTER
- b. +00000 ENTR
- c. +00000 ENTR
- d. +09000 ENTR

Verify that the GIMBAL LOCK indicator on the DSKY's is illuminated. On the G&N Indicator Control Panel verify PGNS light is ON. On the DSKY verify NO ATT light is ON.

6.2.5.1.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the following switches on the G&N Indicator Control Panel to the positions designated.

- a. OPTICS ZERO to ZERO
- b. OPTICS MODE to MANUAL
- c. OPTICS COUPLING to DIRECT
- d. OPTICS SPEED to MED.
- e. OPTICS TEL TRUN to SLAVE to SXT
- f. RETICLE BRIGHTNESS to minimum brightness position

6.2.5.1.3 Set the G/N Power - IMU switch on the LEB Lighting Control Panel to OFF and G&N IMU MN A and MN B circuit breakers on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).

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- 6.2.5.1.3.1 On K-148 enter the following:
- |         |         |              |
|---------|---------|--------------|
| VERB 21 | NOUN 01 | ENTER        |
| 00034   |         | ENTER        |
| 00000   |         | ENTER, ENTER |
| 00760   |         | ENTER        |
| 40000   |         | ENTER        |
- Verify that NO ATT and GIMBAL LOCK lamp indications are OFF.
- 6.2.5.1.4 Set the G&N Power AC1-OFF-AC2 Switch on the Right Hand Circuit breaker panel to OFF and the G&N POWER AC1 and AC2 circuit breakers to OFF (breakers pulled out).
- 6.2.5.1.5 Decrease the LIGHTS - NUMERICS controls on both the Left Hand Circuit Breaker panel and the LAB Lighting Control Panel to the minimum brightness - OFF position.
- 6.2.5.1.6 Set the PSAAM power switch on the PSAAM to OFF.
- 6.2.5.1.7 Set the IMU HTR MN A and MN B circuit breaker on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).
- 6.2.5.1.8 Set the G/N POWER - OPTICS switch on the LEB Lighting Control Panel to OFF and G&N OPTICS MN A and MN B breakers on the Right, Hand Circuit breaker panel to OFF.
- 6.2.5.1.9 Set the COMPUTER MN A and MN B Circuit breakers on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).
- 6.2.5.1.10 Verify that the PTC is supplying inertial components heater power to the G&N System. This will be indicated by the following on the PTC.
- G&N ON (PTC inhibit) light not illuminated.
  - IMU Temp/heater current meter indicates IMU temperature of 130° ±5° F.
- 6.2.5.2 Turn ON Procedure
- 6.2.5.2.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set or verify the following G&N Indicator Control Panel switches to the position indicated.
- CONDITION LAMPS to ON
  - OPTICS ZERO to ZERO
  - OPTICS MODE to MANUAL
  - OPTICS COUPLING to DIRECT
  - OPTICS SPEED to LO
  - OPTICS TEL TRUN to SLAVE to SXT
  - RETICLE BRIGHTNESS to minimum brightness position.
- 6.2.5.2.2 Insure that interfacing system EPS and ECS are turned on and operating properly.
- CAUTION: The remaining procedure must be followed in sequence specified. Failure to adhere to this sequence may require recalibration of the inertial components.

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- 6.2.7.4.7 Enter the following sequence into the K-Start. Push ENTER pushbutton after each entry (-135° MG torquing):
- VERB 24 NOUN 01, ENTER
  - 02504, ENTER
  - 14000, ENTER
  - 00000, ENTER
- Verify on the CRT that ( ) appears in R1, (t) appears in R2, and (b) appears in R3.
- 6.2.7.4.8 Enter the following sequence in the K-Start:
- VERB 42, press ENTER
  - VERB 33, press ENTER (Verify VERB 33 on CRT)
- 6.2.7.4.9 Start analog recorders.
- 6.2.7.4.10 Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When the steady-state condition occurs (approximately 5 minutes), stop the recorders.
- 6.2.7.4.11 Return the G&N System to the coarse align mode by entering the following sequence in the K-Start.
- VERB 40 NOUN 20, press ENTER
  - VERB 41 NOUN 20, press ENTER
  - +00000, press ENTER
  - +00000, press ENTER
  - +00000, press ENTER
- 6.2.7.5 Examine the traces of the recorded measurements for all six phases of this test to detect any sharp discontinuities. Disregard transients of 0.5 second duration or less on the Gimbal Torque motor current traces, disregard transients on the CDU fine error measurement traces. The Gimbal Torque motor currents shall not exceed 0.125 amperes. The CDU Fine Error measurements shall not exceed  $\pm 70$  mv rms. The CDU Coarse Error measurement shall not exceed  $\pm 680$  mv rms.

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| 6.2.9.5                                                                                                                                                                                                                                                                                                                                 |                          |      |
| Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS Caution Lamp on the Indicator Control Panel shall light.                                                                                      |                          |      |
| a.                                                                                                                                                                                                                                                                                                                                      | VERB 06 NOUN 05 flashing |      |
| b.                                                                                                                                                                                                                                                                                                                                      | R1 = +07100±00007        |      |
| c.                                                                                                                                                                                                                                                                                                                                      | R2 = +07100±00007        |      |
| d.                                                                                                                                                                                                                                                                                                                                      | R3 = +07100±00007        |      |
| e.                                                                                                                                                                                                                                                                                                                                      | IG angle = 071±3 deg     |      |
| f.                                                                                                                                                                                                                                                                                                                                      | MG angle = 071±3 deg     |      |
| g.                                                                                                                                                                                                                                                                                                                                      | OG angle = 071±3 deg     |      |
| The GIMBAL LOCK lamps on the DSKY's shall light.                                                                                                                                                                                                                                                                                        |                          |      |
| 6.2.9.6                                                                                                                                                                                                                                                                                                                                 |                          |      |
| Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.                                                                                                                                                                                                                         |                          |      |
| a.                                                                                                                                                                                                                                                                                                                                      | VERB 06 NOUN 06 Flashing |      |
| b.                                                                                                                                                                                                                                                                                                                                      | R1 = +09000±00007        |      |
| c.                                                                                                                                                                                                                                                                                                                                      | R2 = +09000±00007        |      |
| d.                                                                                                                                                                                                                                                                                                                                      | R3 = +09000±00007        |      |
| e.                                                                                                                                                                                                                                                                                                                                      | IG Angle = 090±3 deg     |      |
| f.                                                                                                                                                                                                                                                                                                                                      | MG angle = 090±3 deg     |      |
| g.                                                                                                                                                                                                                                                                                                                                      | OG angle = 090±3 deg     |      |
| 6.2.9.7                                                                                                                                                                                                                                                                                                                                 |                          |      |
| Enter VERB 33 and Press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.                                                                                                                                                                                                                         |                          |      |
| a.                                                                                                                                                                                                                                                                                                                                      | VERB 06 NOUN 07          |      |
| b.                                                                                                                                                                                                                                                                                                                                      | R1 = +13500±00007        |      |
| c.                                                                                                                                                                                                                                                                                                                                      | R2 = +13500±00007        |      |
| d.                                                                                                                                                                                                                                                                                                                                      | R3 = +13500±00007        |      |
| e.                                                                                                                                                                                                                                                                                                                                      | IG angle = 135±3 deg     |      |
| f.                                                                                                                                                                                                                                                                                                                                      | MG angle = 135±3 deg     |      |
| g.                                                                                                                                                                                                                                                                                                                                      | OG angle = 135±3 deg     |      |
| 6.2.9.8                                                                                                                                                                                                                                                                                                                                 |                          |      |
| Enter VERB 33 and press ENTER. After approximately 20 seconds VERB 06 NOUN 8 shall flash. The GIMBAL LOCK lamp shall extinguish on the DSKY's. The PGNS Caution lamp on the Indicator Control Panel shall extinguish. The gimbal angles as displayed in R1, R2 and R3 shall be approximately 135 deg, 135 deg and 45 deg, respectively. |                          |      |
| 6.2.9.9                                                                                                                                                                                                                                                                                                                                 |                          |      |
| Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.                                                                                                                                                                          |                          |      |
| a.                                                                                                                                                                                                                                                                                                                                      | VERB 05 NOUN 07 flashing |      |
| b.                                                                                                                                                                                                                                                                                                                                      | R1 = 00000±00003         |      |
| c.                                                                                                                                                                                                                                                                                                                                      | R2 = 00000±00003         |      |
| d.                                                                                                                                                                                                                                                                                                                                      | R3 = 00000±00003         |      |

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- 6.2.9.22 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds VERB 06 NOUN 91 shall flash on the CRT. The ISS WARNING lamp on the Control Indicator Panel shall extinguish. The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be OFF.
- 6.2.9.23 CAUTION: See paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS MODE switch to CMC.
- 6.2.9.24 Enter VERB 33, press ENTER. After approximately 25 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98 flashing
  - b. R1 = 0000x
  - c. R2 = xxxxx
- Record R1 and R2 as the Shaft Optics CDU drive rate. Shaft rate =  $\frac{R1}{R2}$ . The Shaft Optics CDU drive rate shall be  $15.10 \pm 3.78$  /sec.
- 6.2.9.25 Enter VERB 33 into K148. Press the ENTER pushbutton. In about 15 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98
  - b. R1 = 0000x
  - c. R2 = xxxxx
- Record R1 and R2 as the Trunnion Optics CDU drive rate. Trunnion rate =  $\frac{R1}{R2}$ . The Trunnion Optics CDU drive rate shall be  $3.77 \pm 0.94$  /sec.
- 6.2.9.26 Terminate the Semi-Automatic Moding Check by entering VERB 34 into K148. Observe PROG display on DSKY's is 00. Press the ENTER pushbutton. If Optics testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Panel to OFF.

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- 6.2.10 Zero Optics Test
- 6.2.10.1 Set the G&N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.
- NOTE: Proceed with this test if 6.2.3 Operate Power on test has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2. Turn On Procedure before proceeding.
- INITIALIZATION
- 6.2.10.2 Insure that the following switches on the G&N Indicator Control Panel are set as follows:
- a. OPTICS TEL TRUN to SLAVE to SXT
  - b. OPTICS COUPLING to DIRECT
  - c. OPTICS SPEED to HI
  - d. OPTICS MODE to MAN
- OPTICS ZERO MODE TEST
- 6.2.10.3 Monitor the Optics CDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton.
- 6.2.10.4 CAUTION: See Paragraph 3.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Verify the Optics have zeroed properly by observing the following on R1 and R2 of the CRT.
- a. R1 = +0.00° +0.02° , -0.03° (Shaft Angle)
  - b. R2 = +0.000° +0.006° , -0.007° (Trunnion Los Angle)
- 6.2.10.4.1 Enter the following:
- VERB 01 NOUN 10, ENTER  
00033 ENTER  
Verify R1 = XXX6X
- 6.2.10.4.2 Set the OPTICS ZERO switch to OFF and the OPTICS MODE switch to CMC. Enter the following:
- ENTER  
00033, ENTER  
Verify R1 = XXX5X

**6.2.10.4.3 Set the OPTICS MODE switch to MAN. Press the KEY-REL pushbutton.**

**OPTICS TIME TO ZERO TEST**

**6.2.10.5 Deleted.**

**6.2.10.6 Deleted.**

**6.2.10.7 Deleted.**

**6.2.10.8 Deleted.**

**6.2.10.9 Deleted.**

**6.2.10.10 Deleted.**

**6.2.10.11 Deleted.**



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- 6.2.11.3.1.2 Deleted.
- 6.2.11.4 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS ZERO switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS ZERO switch to OFF.
- 6.2.11.5 Set up the analog recorders to monitor the following measurements:
- a. CG 3170 SCT Trunnion Tachometer Output.
- RESOLVED MODE PHASING AND IMAGE RATE TEST.
- 6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until R1 = +225.00 and R2 = +10.000 on the CRT and the DSKY's.
- 6.2.11.7 Set the OPTICS COUPLING switch on the G&N Panel to RSLV and the OPTICS Speed switch to MED.
- 6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.
- 6.2.11.9 Record time. Quickly displace the OPTICS CONTROL STICK 45±10 degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at 45±10 deg. When target leaves the SCT upper right field of view press MARK pushbutton. The PROG alarm light shall light.
- 6.2.11.10 From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) and the PROG alarm discrete for the period during which the OPTICS CONTROL STICK was being displaced above. The Shaft CDU angle shall be 225.00±10.00 degrees at the time the PROG alarm occurred. The elapsed time from time of OPTICS CONTROL STICK displacement to the time the PROG alarm discrete is obtained shall be 19 to 33 seconds.
- 6.2.11.11 Set the OPTICS COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the optics until R1 = +225.00 and R2 = +10.000. Set the OPTICS COUPLING switch to RSLV.

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- 6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.
- 6.2.11.13 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS COUPLING switch on the G&N Panel to DIRECT.  
Set the OPTICS ZERO switch to ZERO.
- 6.2.12 OPTICS FUNCTIONAL TEST
- 6.2.12.1 Deleted.
- 6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:
- +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8±3 VDC. Record the indication on the CRT.
  - CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.
  - CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT.

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| 6.2.12.3     | Deleted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |  |      |
| 6.2.12.4     | CAUTION: See Paragraph 5.1.2.11 before proceeding.<br>Insure that the Optics control switches on the G&N Indicator Control Panel are set as follows:                                                                                                                                                                                                                                                                                                                                                                                                   |                 |  |      |
|              | a. OPTICS ZERO to ZERO<br>b. OPTICS MODE to MAN<br>c. OPTICS SPEED to LO<br>d. OPTICS COUPLING to DIRECT<br>e. OPTICS TRUN to SLAVE to SXT                                                                                                                                                                                                                                                                                                                                                                                                             |                 |  |      |
| 6.2.12.5     | Set OPTICS ZERO switch to OFF.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |  |      |
| 6.2.12.6     | Resolution checks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |  |      |
| 6.2.12.6.1   | SXT Resolution Check - MSO only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |  |      |
| 6.2.12.6.1.1 | Sight through the SXT eyepiece. Using the OPTICS CONTROL STICK, adjust the SXT to obtain the best reflected field of view of the 5-inch autocollimator reticle engravings at the center of view.                                                                                                                                                                                                                                                                                                                                                       |                 |  |      |
| 6.2.12.6.1.2 | Note that the autocollimator reticle contains a series of lines of different thickness and width. Each set of lines is marked with a number (20, 15, 10, 7, 5, 3) which indicates the angle subtended by one line and one space. View each set of lines to determine the lowest numbered set in which resolution between lines (ability to distinguish separate distinct lines within a set) can be made. Record the number associated with that set of lines. The SXT resolution shall be at least 10 arc seconds at the center of the field of view. |                 |  |      |
| 6.2.12.6.2   | SCT Resolution Check                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |  |      |
| 6.2.12.6.2.1 | Sight through the SCT EYEPIECE. Using the OPTICS CONTROL STICK adjust the SCT to obtain the best view of the SCT RESOLUTION CHART held in the Optics line of sight.                                                                                                                                                                                                                                                                                                                                                                                    |                 |  |      |
| 6.2.12.6.2.2 | Note the chart contains sets of lines. View each set of lines to determine the lowest numbered set in which the resolution between lines (ability to distinguish separate lines within a set) can be made. The SCT shall have a resolution of at least 3 arc minutes at the center of the field of view.                                                                                                                                                                                                                                               |                 |  |      |
| 6.2.12.7     | Slave Telescope Mode Checks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |  |      |
| 6.2.12.7.1   | Verify/perform OPTICS POWER ON TEST per paragraph 6.2.3.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |  |      |

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6.2.12.7.2 Set/Verify following switches on G&N INDICATOR CONTROL PANEL:

- a. OPTICS TEL TRUN - SLAVE to SXT
- b. OPTICS COUPLING - DIRECT
- c. OPTICS SPEED - HI

6.2.12.7.3 Monitor OCDU's by entering VERB 16 NOUN 91 into K-148. Press ENTER.

6.2.12.7.4 Set OPTICS MODE to MAN.

6.2.12.7.5 Using the Optics Hand Controller drive the optics until:

R1 = +000.00±001.00 (SHAFT)  
R2 = +10.000±01.000 (TRUNNION)

6.2.12.7.6 Verify on the CRT and Optics Panel:

SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = R2 ±0.22 DEG

6.2.12.7.7 Set the OPTICS TEL TRUN on the G&N INDICATOR CONTROL PANEL to 0°.

6.2.12.7.8 Verify:

SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = 0.0° ±0.22 DEG

R2 approximately equal to value specified in step 6.2.12.7.5.

6.2.12.7.9 Set the OPTICS TEL TRUN on the G&N INDICATOR CONTROL PANEL to OFFSET 25°.

6.2.12.7.10 Verify on CRT and Optics Panel:

SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = 25° ±1.00 DEG  
R2 approximately equal to value specified in step 6.2.12.7.5.

6.2.12.7.11 On the G&N INDICATOR CONTROL PANEL set the OPTICS TEL TRUN to SLAVE to SXT.

6.2.12.7.12 Verify on CRT and Optics Panel:

SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = R2 ±0.22 DEG

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- 6.2.12.7.13 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
On the G&N INDICATOR CONTROL PANEL set the OPTICS ZERO to ZERO. Wait 15 sec.
- 6.2.12.7.14 Verify on CRT and OPTICS PANEL.
- R1 = 000.00 +000.02, -000.03  
R2 = 00.000 +00.006, -00.007"
- SHAFT TPAC = R1 ± 0.11 DEG  
TRUN TPAC = R2 ± 0.22 DEG
- 6.2.12.7.15 If Optics testing will not be continued, set the G&N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.8 SXT Parallelism Tests
- 6.2.12.8.1 Remove the plug from the base of the SXT eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light.
- NOTE: If needed to reduce external light, place a photographers hood over the optics head.
- 6.2.12.8.2 SXT Auto Collimator Parallelism Test - MSO only.
- 6.2.12.8.2.1 Using the OPTICS CONTROL STICK drive the SXT SLOS Trunnion to +15.00° ± 2° as indicated in R2 of the DSKY. Maintain a Shaft CDU angle of 000.00 ± 0.10 degrees.
- 6.2.12.8.2.2 Sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to superimpose the SXT LLOS horizontal reticle image upon the autocollimator horizontal filar. Record the autocollimator reading.
- 6.2.12.8.2.3 Repeat 6.2.12.8.2.2 twice. Calculate and record the average of the three autocollimator readings.
- 6.2.12.8.2.4 Set the OPTICS ZERO switch to ZERO.
- 6.2.12.8.2.5 Again sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to bring the SXT SLOS horizontal reticle and autocollimator horizontal filar images to coincide. Record the autocollimator reading.

- 6.2.12.8.2.6 Repeat 6.2.12.8.2.5 twice. Calculate and record the average of the three autocollimator readings. The average value obtained here shall not differ from that obtained in 6.2.12.2.3 by more than 10 arc seconds.
- 6.2.12.8.3 Deleted.
- 6.2.12.8.3.1 Deleted.
- 6.2.12.8.3.2 Deleted.
- 6.2.12.8.3.3 Deleted.
- 6.2.12.8.3.4 Deleted.
- 6.2.12.9 SXT, CMC Functional Check
- 6.2.12.9.1 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch to MAN. Set the OPTICS ZERO switch to ZERO. After 15 seconds, return the switch to OFF.
- 6.2.12.9.2 Sight through the SXT. Using the Control Stick align the SXT SLOS with Optical Target No. 1.

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- 6.2.12.9.3 When aligned, record the value of the Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.4 Sight through the SXT. Using the Control Stick align the SXT StLOS with Optical Target No. 2.
- 6.2.12.9.5 When aligned, record the value of the Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.6 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. After 15 seconds set the OPTICS ZERO switch to OFF. Set the OPTICS MODE switch to CMC.
- 6.2.12.9.7 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.3 into the DSKY and press ENTER. Enter the value for Trunnion from 6.2.12.9.3 into the DSKY and press ENTER.
- 6.2.12.9.8 Sight through the SXT. The StLOS should be approximately centered on the Optical Target No. 1. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.3 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.9 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton. Enter the value for Trunnion from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton.
- 6.2.12.9.10 Sight through the SXT. The StLOS should be approximately centered on the Optical Target No. 2. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.11 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds.
- 6.2.12.9.12 If OPTICS testing will not continue, set the G&N Power Optics switch on the LEB Lighting Panel to OFF.

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6.2.13 Optics Slew Rate Test.

6.2.13.1 Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following signals on the CRT.

- a. +28 VDC OPTICS OPERATE BUS (CG 1530) is +28.0±3.0 VDC.
- b. OPTX 28V 800 cps 1% 0° ph not flashing on the CRT.
- c. OPTX 28V 800 cps 5% -90° ph not flashing on the CRT.

6.2.13.1.1 Verify and/or set the following switches on the G&N Indicator Control Panel to the positions indicated:

- a. OPTICS TEL TRUN to SLAVE to SXT
- b. OPTICS COUPLING to DIRECT
- c. OPTICS SPEED to HI
- d. OPTICS MODE to MAN.

6.2.13.2 Monitor the OCDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton. Insure RECORD DSKY and RECORD DOWNLINK on R-145 are ON.

6.2.13.3 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch on the G&N Indicator Panel to OFF. Set the OPTICS MODE switch to MAN.

NOTE: Read and understand step 6.2.13.4 before proceeding. Do not hold Control Stick at upper limit more than 10 seconds or exceed a trunnion angle of 85°.

TRUNNION SLEW RATE - HI SPEED

6.2.13.4 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 7 seconds release the control stick. Record the SXT Trunnion Servo Error In-Phase output (CG 3118) signal on the CRT while slewing the optics. The voltage shall be -0.25 to -2.00 VRMS.

6.2.13.5 Perform the following calculations:

From the Uplink file tape, the compressed data tape or the PCM tape request a data reduction of the trunnion CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the rate test was being performed.

Calculate the slew rate by dividing the ΔCDU angle by the elapsed time.

The Trunnion slew rate shall be 10.0±2.0 deg/sec.



## SHAFT SLEW RATE - HI SPEED

6.2.13.6 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.

NOTE: Read and understand step 6.2.13.7 before proceeding. Do not hold Control Stick at right limit for more than 10 seconds or exceed a shaft angle of 250°.

6.2.13.7 Record time. Push and hold the Optics Control stick to its right limit. After approximately 7 seconds release the control stick.

Record the EXT SHU<sup>®</sup> Servo Error In-Phase Output (CG 3117) signal on the CRT while slewing the optics. The voltage shall be -0.25 to -2.00 VRMS.

6.2.13.8 Perform the following calculations:

From the uplink file tape, the compressed data tape or the PCM tape, request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the rate test was being performed.

Calculate the rate by dividing the ACDU angle by the elapsed time.

The Shaft slew rate shall be 19.5±3.9 deg/sec.

## TRUNNION SLEW RATE - MED SPEED

6.2.13.9 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS SPEED switch to MED.

NOTE: Read and understand 6.2.13.10 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.

6.2.13.10 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick. Record the EXT TRUN MTR Control Winding (CG 3155) and EXT Trun Tach (CG 3150) signals while slewing the optics. CG 3155 shall be +0.25 to +2.00 VRMS. CG 3150 shall be +0.33±0.13 VRMS.

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- 6.2.13.11 Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU registers (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.
- The Trunnion slew rate shall be  $1.0 \pm 0.2$  deg/sec.
- SHAFT SLEW RATE - MED SPEED
- 6.2.13.12 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.
- NOTE: Read and understand 6.2.13.13 before proceeding. Do not hold control stick at right limit for more than 20 seconds.
- 6.2.13.13 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick. Record the SXT Shaft MTR Control Winding (CG 3145) and SXT Shaft Tach (CG 3140) signals while slewing the optics. CG 3145 shall be  $+0.50$  to  $+4.00$  VRMS. CG 3140 shall be  $0.33 \pm 0.13$  VRMS.
- 6.2.13.14 Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.
- The Shaft slew rate shall be  $2.0 \pm 0.4$  deg/sec.
- TRUNNION SLEW RATE - LO SPEED
- 6.2.13.15 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS SPEED switch to LO.
- NOTE: Read and understand 6.2.13.16 before proceeding. Do not hold control stick at upper limit for more than 30 seconds.

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6.2.13.16 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.

6.2.13.17 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.

Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.

The Trunnion slew rate shall be  $0.10 \pm 0.02$  deg/sec.

SHAFT SLEW RATE - LO SPEED

6.2.13.18 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.

NOTE: Read and understand 6.2.13.18 before proceeding. Do not hold control stick at right limit for more than 20 seconds.

6.2.13.19 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.

6.2.13.20 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.

Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.

The Shaft slew rate shall be  $0.20 \pm 0.04$  deg/sec.

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OPTICS HAND CONTROLLER DRIFT RATE CHECK - LO SPEED

- 6.2.13.21 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set  
the OPTICS ZERO switch to OFF. Record time. Wait 60 seconds.
- 6.2.13.22 Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM  
tape request a data reduction of the Trunnion and Shaft CDU  
registers (addresses 35 and 36 respectively) and the TIME 2  
and TIME 1 registers (addresses 24 and 25 respectively) for  
the 60 second period during which the drift rate test was being  
performed.
- Calculate the drift rate by dividing the  $\Delta$ CDU angles by the elapsed  
time.
- The Trunnion drift rate shall be less than .0167 deg/sec.
- The Shaft drift rate shall be less than .0333 deg/sec.
- 6.2.13.23 NOPTICS testing will not continue; set the G/N Power-Optics  
switch on the LEB Lighting Control Panel to OFF.

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- 6.2.16.6 Verify that the IMU Operate Power has been applied for at least one hour.
- 6.2.16.7.1 Deleted.
- 6.2.16.7.2 Deleted
- 6.2.16.7.3 VERB 92 ENTR
- 6.2.16.7.4 Enter 00001 into K148. Press the ENTER pushbutton.
- 6.2.16.7.5 On the CRT DSKY display VERB 06 NOUN 41 shall flash. Verify R1 (Nav Base Azimuth) and R2 (Site Latitude) are correct.
- 6.2.16.7.6 If values for R1 and R2 are correct, proceed to next step. If values for R1 and R2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR  
 +XXX.XX ENTR (Correct navigation base azimuth  $\pm 0.80$  deg)  
 +XX.XXX ENTR (Correct site latitude from Table XX)  
 Verify values in R1 and R2 are correct.

TABLE XX

| LOCATION | LATITUDE |
|----------|----------|
| NAA      | +33.921  |
| MSC      | +29.556  |
| KSC-MBO  | +28.523  |
| KSC-VAB  | +28.585  |
| KSC-PAD  | +28.607  |

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- 6.2.16.7.16 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (+NBDZ) position +00002.
- 6.2.16.7.17 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.2.16.7.18 In approximately 90 secs, VERB 06 NOUN 98 shall flash. From the CRT, record R1 and R2 (-X PIPAG) Position +00002.
- 6.2.16.7.19 VERB 33 ENTR
- 6.2.16.7.20 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (-NBDX + ADLAX) Pos. +00002. Record CRT CDU gimbal angle indications and time.
- 6.2.16.7.21 On K-148 enter the following sequence:  
VERB 34 ENTR  
VERB 06 NOUN 98 shall flash
- 6.2.16.7.22 On CRT, DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00003.  
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:  
VERB 25 ENTR  
+00900 ENTR (Test Time in Seconds)  
+00000 ENTR (Test Index Number)  
+00003 ENTR (Test Position Entry)
- 6.2.16.7.23 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.2.16.7.24 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2 (-NBDX) Position +00003.
- 6.2.16.7.25 On K-148 enter the following sequence:  
VERB 33 ENTR

|        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                         |
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| 6.2.16.10.1 Measured Values                                                                                                                                                                                                                                                                                                                                                       |              |                 |                                                                             |                |
| Line                                                                                                                                                                                                                                                                                                                                                                              | Position No. | Step No.        | Parameter                                                                   | Recorded Value |
| 6.2.16.10.1.1                                                                                                                                                                                                                                                                                                                                                                     | 1            | +00001          | 6.2.16.7.10 +NBDY                                                           | R2             |
| 6.2.16.10.1.2                                                                                                                                                                                                                                                                                                                                                                     | 2            | +00001          | 6.2.16.7.12 +XPIPAG                                                         | R1 - R2        |
| 6.2.16.10.1.3                                                                                                                                                                                                                                                                                                                                                                     | 3            | +00002          | 6.2.16.7.16 +NBDZ                                                           | R2             |
| 6.2.16.10.1.4                                                                                                                                                                                                                                                                                                                                                                     | 4            | +00002          | 6.2.16.7.18 -X PIPAG                                                        | R1 - R2        |
| 6.2.16.10.1.5                                                                                                                                                                                                                                                                                                                                                                     | 5            | +00002          | 6.2.16.7.20 -NBDX + ADIAX                                                   | R2             |
| 6.2.16.10.1.6                                                                                                                                                                                                                                                                                                                                                                     | 6            | +00003          | 6.2.16.7.24 -NBDX                                                           | R2             |
| 6.2.16.10.1.7                                                                                                                                                                                                                                                                                                                                                                     | 7            | +00003          | 6.2.16.7.26 +ZPIPAG                                                         | R1 - R2        |
| 6.2.16.10.1.8                                                                                                                                                                                                                                                                                                                                                                     | 8            | +00004          | 6.2.16.7.30 +NBDY + ADSRAY                                                  | R2             |
| 6.2.16.10.1.9                                                                                                                                                                                                                                                                                                                                                                     | 9            | +00004          | 6.2.16.7.32 -ZPIPAG                                                         | R1 - R2        |
| 6.2.16.10.1.10                                                                                                                                                                                                                                                                                                                                                                    | 10           | +00004          | 6.2.16.7.34 +NBDZ + ADIAZ                                                   | R2             |
| 6.2.16.10.1.11                                                                                                                                                                                                                                                                                                                                                                    | 11           | +00005          | 6.2.16.7.39 +YPIPAG                                                         | R1 - R2        |
| 6.2.16.10.1.12                                                                                                                                                                                                                                                                                                                                                                    | 12           | +00006          | 6.2.16.7.44 -YPIPAG                                                         | R1 - R2        |
| 6.2.16.10.1.13                                                                                                                                                                                                                                                                                                                                                                    | 13           | +00007          | 6.2.16.7.48 -NBDX + .707 ADSRAX                                             | R2             |
| 6.2.16.10.1.14                                                                                                                                                                                                                                                                                                                                                                    | 14           | +00008          | 6.2.16.7.52 .707 (-NBDZ-NBDY)<br>+.5 (ADIAX-ADIAZ)<br>+.5 (ADSRAY + ADSRAZ) | R2             |
| 6.2.16.10.1.15                                                                                                                                                                                                                                                                                                                                                                    | 15           | +00009          | 6.2.16.7.56 -NBDZ + .707 ADSRAZ                                             | R2             |
| 6.2.16.10.1.16                                                                                                                                                                                                                                                                                                                                                                    | 16           | +00010          | 6.2.16.7.60 .707 (NBDY - NBDX)<br>+.5 (ADIAZ - ADIAX)<br>+.5 ADSRAX         | R2             |
| 6.2.16.10.1.17 Y PIPA Data Correction Calculation.                                                                                                                                                                                                                                                                                                                                |              |                 |                                                                             |                |
| 6.2.16.10.1.17.1 From the uplink file tape, the compressed data tape or the PCM tape, request a data reduction of the X and Z accelerometer ΔV counts (addresses 37 and 41 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the period during which the Y PIPA test was being performed in positions 5 and 6 of the IMU Performance test. |              |                 |                                                                             |                |
| 6.2.16.10.1.17.2 Perform the following calculations for position 5.                                                                                                                                                                                                                                                                                                               |              |                 |                                                                             |                |
| $G'_5 = \frac{G_5}{\cos \theta_{G_5}}$                                                                                                                                                                                                                                                                                                                                            |              |                 |                                                                             |                |
| where:                                                                                                                                                                                                                                                                                                                                                                            |              |                 |                                                                             |                |
| G <sub>5</sub> = Measured acceleration term (line 11)                                                                                                                                                                                                                                                                                                                             |              |                 |                                                                             |                |
| G' <sub>5</sub> = Corrected acceleration term                                                                                                                                                                                                                                                                                                                                     |              |                 |                                                                             |                |



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|          |                                                                                                                                                                                                                                                                                                      |
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| 6.2.17   | SXT-NB-Fine Alignment Test                                                                                                                                                                                                                                                                           |
| 6.2.17.1 | Deleted                                                                                                                                                                                                                                                                                              |
| 6.2.17.2 | The G&N shall have had OPERATE power applied for a minimum of 1 hour.                                                                                                                                                                                                                                |
| 6.2.17.3 | Set the G/N POWER-OPTICS switch to OPTICS. Verify that +28 VDC OPTICS OPERATE BUS (CG 1530) is +28.0±3.0 VDC. Verify that the OPTX 28V 800 cps 1% 0° ph (CG 1211) and OPTX 28V 800 cps 5% -90° ph (CG 1212) are not flashing on the CRT.                                                             |
| 6.2.17.4 | Deleted.                                                                                                                                                                                                                                                                                             |
| 6.2.17.5 | CAUTION: See Paragraph 5.1.2.11 before proceeding.<br>On the G&N Indicator Control Panel set the following switches to the position indicated.<br><br>a. OPTICS TEL TRUN to SLAVE to SXT<br>b. OPTICS COUPLING to DIRECT<br>c. OPTICS SPEED to LO<br>d. OPTICS MODE to MAN<br>e. OPTICS ZERO to ZERO |
| 6.2.17.6 | Deleted.                                                                                                                                                                                                                                                                                             |

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| 6.2.17.18 | Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.                                                                                                                                                                                                                                                        |  |  |  |      |
|           | a. R1 = +xxx.xx (Target 2 Azimuth)                                                                                                                                                                                                                                                                                                                           |  |  |  |      |
|           | b. R2 = -xxx.xxx (Target 2 Elevation)                                                                                                                                                                                                                                                                                                                        |  |  |  |      |
|           | c. R3 = 00002                                                                                                                                                                                                                                                                                                                                                |  |  |  |      |
| 6.2.17.19 | If the data displayed is correct proceed to 6.2.17.22. If R1 and R2 do not contain the correct azimuth and elevation for Target 2, correct the data by entering the following sequence into the DSKY.                                                                                                                                                        |  |  |  |      |
|           | a. VERB 24, ENTER                                                                                                                                                                                                                                                                                                                                            |  |  |  |      |
|           | b. +xxx.xx+00.10 degrees, ENTER (Target 2 Azimuth)                                                                                                                                                                                                                                                                                                           |  |  |  |      |
|           | c. -xxx.xxx+00.010 degrees, ENTER (Target 2 Elevation)                                                                                                                                                                                                                                                                                                       |  |  |  |      |
| 6.2.17.20 | CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to OFF. Enter VERB 33, ENTER into the DSKY.                                                                                                                                                                                                                                    |  |  |  |      |
| 6.2.17.21 | When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00001, on the DSKY set the OPTICS MODE switch on the G&N Indicator Control Panel to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL. |  |  |  |      |
| 6.2.17.22 | Using the Optics Hand Controller, align the SXT SLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.                             |  |  |  |      |
| 6.2.17.23 | When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement of the TPAC, set the OPTICS MODE switch to MANUAL.                                                                                     |  |  |  |      |
| 6.2.17.24 | Using the Optics Hand Controller, align the SXT SLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.                         |  |  |  |      |
|           | NOTE: The following two MARKS must be performed as quickly as possible. In no case shall the time between the first and second MARK exceed two minutes.                                                                                                                                                                                                      |  |  |  |      |
| 6.2.17.25 | After 30 seconds observe the DSKY for VERB 51 and NOUN 70 flashing and R1 = 00001. Set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.                             |  |  |  |      |

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- 6.2.18.5 To change the launch azimuth perform the following:
- VERB 76, ENTER
  - R1 displays present launch azimuth
  - To change launch azimuth enter  
 VERB 21, ENTER  
 \*XXX.XX ENTER (New launch azimuth)
- 6.2.18.6 When PROG display changes to 02 record time as  $T_0$ .
- 6.2.18.7 Gyro Compassing Stability
- 6.2.18.7.1 120 minutes after  $T_0$  record the Outer, Inner and Middle CDU Gimbal angles from the CRT.
- 6.2.18.7.2 Repeat above step every 5 minutes for the next 120 minutes.
- 6.2.18.7.3 The peak to peak spread of the outer gimbal angle shall not exceed  $0.12^\circ$ .
- 6.2.18.7.4 The peak to peak spread of the Inner and Middle gimbal angles shall not exceed  $0.06^\circ$ .
- 6.2.18.8 Gyro Compassing Accuracy
- 6.2.18.8.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. After 240 minutes from  $T_0$  set the OPTICS ZERO switch on the G&N Indicator to ZERO.
- 6.2.18.8.2 Deleted.

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- 6.2.18.8.11 Set the OPTICS SPEED switch to HI. Using the Optics Hand Controller, drive the SXT StLOS to the approximate position of Target 2.
- 6.2.18.8.12 Set the OPTICS SPEED switch to LO. Using the Optics Hand Controller, align the SXT StLOS to Target 2 and press the MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied, press the MARK REJECT pushbutton and repeat this step.
- 6.2.18.8.13 On the DSKY observe the following data displayed:
- a. VERB 06 NOUN 93
  - b. R1 =  $\pm$ XX.XXX (X gyro elevation error, deg. 4 hr.)
  - c. R2 =  $\pm$ XX.XXX (Y gyro elevation error, deg. 4 hr.)
  - d. R3 =  $\pm$ XX.XXX (Z gyro azimuth error, deg. 4 hr.)
- Record R1, R2 and R3. The X and Y gyro elevation error shall be  $0.00 \pm 0.045$  degrees and the Z gyro azimuth error shall be  $0.00 \pm 0.573$  degrees.
- 6.2.18.8.14 CAUTION: See Paragraph 5.1.2.11 before proceeding. Enter VERB 34, ENTER into the DSKY. Observe the PROGRAM display change to 03. Set the Optics ZERO Switch on the G&N Indicator Control Panel to ZERO.
- 6.2.18.8.15 Enter VERB 36 into the DSKY. Press the enter pushbutton.
- 6.2.18.8.16 Enter VERB 41 NOUN 20 into the DSKY. Press the ENTER pushbutton. Enter +00000 into the DSKY three times. Press the ENTER pushbutton after each entry. Set the G&N Power Optics switch on the LEB Lighting Control Panel to OFF.
- 6.2.19 CMC Voltage Margin Test
- 6.2.19.1 Verify that the G&N IMU HTR MNA & MNB circuit breakers are engaged, Computer NMA & NMB breakers are engaged, IMU MNA & MNB circuit breakers are not engaged, and the G&N Power - IMU switch on the LEB Lighting Control Panel is in the OFF position.
- 6.2.19.2 On the PSA Adapter Module set the INHIBIT VOLTAGE FAIL switch to ON.
- Caution: During the performance of this test the +4 VDC CMC Power Supply shall not be operated at less than +2.5 VDC or greater than 5.2 VDC (CG 1030). The +14 VDC CMC Power Supply shall not be operated at less than +8.5 VDC or greater than +17.0 VDC (CG 1020). Rotate the LEB LTS NUMERICS SEL. to approximately center position. Decrease to absolute minimum discernable lighting.
- Note: The flashing indication of the CMC Power Supplies on CRT may be disregarded for this test. The charts in Table I may be used to determine approximate values for the "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.

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- 6.2.19.3 Into R154 insert 0001. Verify and execute.
- 6.2.19.3.1 Into R153 insert 1100. Verify and execute.
- 6.2.19.4 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.5 Into C156 insert -050001234. Verify and execute. Verify on the CRT that GV0106 is between -4.0 and -6.0 VDC.
- 6.2.19.6 Into R154 insert 0111. Verify and execute.
- 6.2.19.7 Observe CG 1020, +14 VDC CMC Power Supply and CG 1030, +4 VDC CMC Power Supply, on the CRT. Repeat 6.2.19.3 through 6.2.19.6 adjusting each C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC and CG 1030 is +3.40 (+0.03 - 0.00) VDC.
- 6.2.19.8 Initiate CMC Self Check by inserting the following into K148:
- a. ERROR RESET
  - b. VERB 21 NOUN 27, ENTER
  - c. 77777, ENTER
- Wait 200 seconds
- 6.2.19.9 Insure that the DSKY RESTART lamp and Program Alarm lamp does not light.
- 6.2.19.9.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.10 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify the RESTART lamp on the DSKY is lighted. Disregard other DSKY indications. If RESTART does not light, repeat 6.2.19.3. Verify CMC Warning masters alarm are lighted.
- 6.2.19.11 Set the INHIBIT VOLTAGE FAIL switch to ON. Insert the following into K148:
- a. ERROR RESET
  - b. VERB 21 NOUN 27, ENTER
  - c. 77777, ENTER
- 6.2.19.12 Into R154 insert 0001. Verify and execute.
- 6.2.19.13 Into C156 insert +106001244. Verify and execute. Verify on the CRT that GV0116 is between +9.8 and +11.8 VDC.
- 6.2.19.14 Into R154 insert 0111. Verify and execute.
- 6.2.19.15 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.12 through 6.2.19.14 adjusting the C-Start entry until CG 1020 is 16.4 (+0.0, -0.1) VDC.

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APPENDIX I

| Signal  | Link | Nomenclature                | G&N Test Requirement                         | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|-----------------------------|----------------------------------------------|----------------------------------------------|
| CG 1020 | 1    | +14 VDC CMC SUPPLY          | +14.0±0.4 VDC                                | 0%                                           |
| CG 1030 | 1    | +4 VDC CMC SUPPLY           | +4.00±0.2 VDC                                | 0%                                           |
| CG 1040 | 2    | +120 VDC PIPA SUPPLY        | +120±6.0 VDC                                 | 1%                                           |
| CG 1051 | 1    | +20 VDC PIPA SUPPLY         | +20.0±1.2 VDC                                | 0%                                           |
| CG 1052 | 1    | -20 VDC PIPA SUPPLY         | -20±2 VDC                                    | 0%                                           |
| CG 1070 | 1    | +4 VDC CDU SUPPLY           | +4.0±0.2 VDC                                 | 0%                                           |
| CG 1100 | 1    | -28 VDC SUPPLY              | -27.5±6.0 VDC                                | 0%                                           |
| CG 1110 | 2    | 2.5 VDC TM BIAS             | +2.50±0.05 VDC                               | 0%                                           |
| CG 1201 | 2    | IMU 28V .8KC 1% 0° RMS      | 28.00±0.56 VRMS                              | 1%                                           |
| CG 1202 | 1    | IMU 28V .8KC 5% - 90° RMS   | 28.0±1.4 VRMS                                | 1.5%                                         |
| CG 1203 | 1    | IMU 28V .8KC 0° RMS         | 28.0±2.1 VRMS                                | 1.5%                                         |
| CG 1207 | 1    | PH DIFF IMU 5% 0°, -90°     | -90±10°                                      | 3%                                           |
| CG 1211 | 1    | OPTX 28V .8KC 1% 0° RMS     | 28.00±0.56 VRMS                              | 1.5%                                         |
| CG 1212 | 1    | OPTX 28V .8KC 5% - 90° RMS  | 28.00±1.48 VRMS                              | 1.5%                                         |
| CG 1220 | 1    | PH DIFF OPTX 1% IMU 1%      | 0° ±10°                                      | 3%                                           |
| CG 1331 | 2    | 3.2 KC 28V SUPPLY           | 28.0±0.56 VRMS                               | 1%                                           |
| CG 1336 | 1    | PH DIFF 3.2 KC 28V/CMC SYNC | 0° ±10°                                      | 3%                                           |
| CG 1500 | 1    | +28 VDC IMU OPERATE BUS     | 28.8±3 VDC                                   | 0%                                           |
| CG 1510 | 1    | +28 VDC IMU STANDBY BUS     | 28.8±3 VDC                                   | 0%                                           |
| CG 1520 | 1    | +28 VDC CMC OPERATE BUS     | 28.8±3 VDC                                   | 0%                                           |
| CG 1530 | 1    | +28 VDC OPTX CPERATE BUS    | 28.8±3 VDC                                   | 0%                                           |
| CG 2001 | 2    | X PIPA SG O/P               | 5 VRMS max                                   | 3%                                           |
| CG 2021 | 2    | Y PIPA SG O/P               | 5 VRMS max                                   | 3%                                           |
| CG 2041 | 2    | Z PIPA SG O/P               | 5 VRMS max                                   | 3%                                           |
| CG 2108 | 1    | IG SERVO ERROR QUAD         | 0.0±1.2 VRMS                                 | 3%                                           |
| CG 2112 | 2    | IG 1X RESOLVER O/P SIN      | 18.38±1.84 VRMS @ 45°                        | 2.5%                                         |
| CG 2113 | 2    | IG 1X RESOLVER O/P COS      | 18.38±1.84 VRMS @ 45°                        | 2.5%                                         |
| CG 2117 | 2    | IG SERVO ERROR IN PHASE     | 0.0±60 mv RMS @ null                         | 2%                                           |
| CG 2120 | 1    | IG TORQUE MOTOR CURRENT     | 0.125 amp max during Fine Alignment Torquing | 0%                                           |
| CG 2138 | 1    | MG SERVO ERROR QUAD         | 0.0±1.2 VRMS                                 | 3%                                           |
| CG 2142 | 2    | MG 1X RESOLVER O/P SIN      | 18.38±1.84 VRMS @ 45°                        | 2.5%                                         |
| CG 2143 | 2    | MG 1X RESOLVER O/P COS      | 18.38±1.84 VRMS @ 45°                        | 2.5%                                         |
| CG 2147 | 2    | MG SERVO ERROR IN PHASE     | 0.0±60 mv rms @ null                         | 2%                                           |
| CG 2150 | 1    | MG TORQUE MOTOR CURRENT     | 0.125 amp max during Fine Align Torquing     | 0%                                           |
| CG 2168 | 1    | OG SERVO ERROR QUAD         | 0.0±1.2 VRMS                                 | 3%                                           |
| CG 2172 | 2    | OG 1X RESOLVER O/P SIN      | 18.38±1.84 VRMS @ 45°                        | 2.5%                                         |
| CG 2173 | 2    | OG 1X RESOLVER O/P COS      | 18.38±1.84 VRMS @ 45°                        | 2.5%                                         |
| CG 2177 | 2    | OG SERVO ERROR IN PHASE     | 0.0±60 mv RMS @ null                         | 2%                                           |
| CG 2180 | 1    | OG TORQUE MOTOR CURRENT     | 0.125 amp max during Fine Align Torquing     | 0%                                           |
| CG 2219 | 1    | PITCH ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS @ 17°                          | 2%                                           |
| CG 2220 | 1    | IG CDU FINE ERROR           | 0.0±0.07 VRMS @ null                         | 1%                                           |

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| Signal  | Link | Nomenclature                     | G&N Test Requirement            | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|----------------------------------|---------------------------------|----------------------------------------------|
| CG 2221 | 1    | IG CDU COARSE ERROR              | 0.0±0.68 VRMS at null           | 1%                                           |
| CG 2249 | 1    | YAW ATT ERROR-CDU DAC O/P        | 5.06±0.5 VRMS at 17°            | 2%                                           |
| CG 2250 | 1    | MG CDU FINE ERROR                | 0.0±0.07 VRMS at null           | 1%                                           |
| CG 2251 | 1    | MG CDU COARSE ERROR              | 0.0±0.68 VRMS at null           | 1%                                           |
| CG 2279 | 1    | ROLL ATT ERROR-CDU DAC O/P       | 5.06±0.5 VRMS at 17°            | 2%                                           |
| CG 2280 | 1    | OG CDU FINE ERROR                | 0.0±0.07 VRMS at null           | 1%                                           |
| CG 2281 | 1    | OG CDU COARSE ERROR              | 0.0±0.68 VRMS                   | 1%                                           |
| CG 2300 | 2    | PIPA TEMPERATURE                 | 130.5±1.5°F Operate Mode        | 2%                                           |
| CG 3011 | 1    | TRUNNION CDU FINE ERROR          | 0.0±0.07 VRMS at null           | 1%                                           |
| CG 3021 | 1    | SHAFT CDU FINE ERROR             | 0.0±0.07 VRMS at null           | 1%                                           |
| CG 3117 | 1    | SXT SHAFT SERVO ERROR IN PH      | -0.25 to -2.00 VRMS at Hi Rate  | 2%                                           |
| CG 3118 | 1    | SXT TRUNNION SERVO ERROR IN PH   | -0.25 to -2.00 VRMS at Hi Rate  | 2%                                           |
| CG 3140 | 1    | SXT SHAFT TACH O/P               | 3.3±1.3 VRMS at Hi Rate         | 2%                                           |
| CG 3145 | 1    | SXT SHAFT MTR CONTROL WINDING    | +0.5 to 4.00 VRMS at Med Rate   | 2%                                           |
| CG 3150 | 1    | SXT TRUNNION TACH O/P            | 3.3±1.3 VRMS at Hi Rate         | 2%                                           |
| CG 3155 | 1    | SXT TRUNNION MTR CONTROL WINDING | +0.25 to +2.00 VRMS at Med Rate | 2%                                           |
| CG 3160 | 1    | SCT SHAFT TACK O/P               | 3.3±1.3 VRMS at Hi Rate         | 2%                                           |
| CG 3170 | 1    | SCT TRUNNION TACH O/P            | 0.85±0.35 VRMS at Hi Rate       | 2%                                           |
| CG 3721 | 2    | SHAFT CDU DAC O/P                | 10.12±1.00 VRMS at 17°          | 1%                                           |
| CG 3722 | 2    | TRUNNION CDU DAC O/P             | 10.12±1.00 VRMS at 17°          | 1%                                           |
| CG 4300 | 1    | CMC TEMP                         | 87.5±42.5°F                     | 0%                                           |
| CG 6020 | 1    | PIPA CAL MODULE TEMP             | 72.5±27.5°F                     | 0%                                           |
| CG 6021 | 1    | IMU 800 cps 5% TEMP (PSA)        | 90±30°F                         | 0%                                           |
| CG 2301 | 1    | IRIG TEMPERATURE                 | 135±2.5°F in Operate            | 2%                                           |
| CG 1021 | 1    | +14V CMC SUPPLY NOISE RMS        | 0.2 VRMS MAX                    | 0%                                           |
| CG 1031 | 1    | +4V CMC SUPPLY NOISE RMS         | 0.2 VRMS MAX                    | 0%                                           |
| CG 1042 | 1    | +120 VDC PIPA SUP NOISE RMS      | 1.5 VRMS MAX                    | 0%                                           |
| CG 1053 | 1    | +20 VDC PIPA SUP NOISE RMS       | 1.0 VRMS MAX                    | 0%                                           |
| CG 1071 | 1    | +4 VDC CDU SUP NOISE RMS         | 0.1 VRMS MAX                    | 0%                                           |
| CG 1501 | 1    | +28V IMU OPERATE BUS NOISE RMS   | 1.0 VRMS MAX                    | 0%                                           |
| CG 1511 | 1    | +28V IMU STANDBY BUS NOISE RMS   | 1.0 VRMS MAX                    | 0%                                           |
| CG 1521 | 1    | +28V CMC OPERATE BUS NOISE RMS   | 2.0 VRMS MAX                    | 0%                                           |
| CG 1531 | 1    | +28V OPTX OPERATE BUS NOISE RMS  | 2.0 VRMS MAX                    | 0%                                           |

PSAAM OUTPUT is the source of Link 1 signals. SCA OUTPUT is the source of Link 2 signals.

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| Change 8  | Replace paragraph 6.2.3.1.2 with the following:<br><br>6.2.3.1.2 Switches and selectors on the G&N Indicator control panel shall be set as follows:<br><br>a. OPTICS MODE to MANUAL<br>b. CONTROLLER COUPLING to DIRECT<br>c. CONTROLLER SPEED to MED<br>d. TELESCOPE TRUNNION to SLAVE to SXT<br>e. RETICLE BRIGHTNESS to minimum brightness position.                                                                                       |
| Change 9  | Replace paragraph 6.2.3.2.3.2 with the following:<br><br>6.2.3.2.3.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE on the G&N Indicator Control Panel to ZERO. Wait 15 seconds.                                                                                                                                                                                                                                      |
| Change 10 | Replace paragraph 6.2.5.1.2 with the following:<br><br>6.2.5.1.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the following switches on the G&N Indicator Control Panel to the positions designated:<br><br>a. OPTICS MODE to ZERO<br>b. CONTROLLER MODE to DIRECT<br>c. CONTROLLER SPEED to LO<br>d. TELESCOPE TRUNNION to SLAVE to SXT<br>e. RETICLE BRIGHTNESS to minimum brightness position                                    |
| Change 11 | Replace paragraph 6.2.5.2.1 with the following:<br><br>6.2.5.2.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set or verify the following G&N Indicator Control Panel switches to the positions indicated.<br><br>a. CONDITION LAMPS to ON<br>b. OPTICS MODE to ZERO<br>c. CONTROLLER COUPLING to DIRECT<br>d. CONTROLLER SPEED to LO<br>e. TELESCOPE TRUNNION to SLAVE to SXT<br>f. RETICLE BRIGHTNESS to minimum brightness position. |
| Change 12 | Replace paragraph 6.2.9.23 with the following:<br><br>6.2.9.23 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to CMC.                                                                                                                                                                                                      |
| Change 13 | Replace sections 6.2.10 and 6.2.11 with the following:<br><br>6.2.10 Zero Optics Test<br><br>6.2.10.1 Set the G&N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.                                                                                                                                                                                                                                                            |



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NOTE: Proceed with this test if 6.2.3 Operate Power on Test has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 Turn On Procedure before proceeding.

#### INITIALIZATION

6.2.10.2 Insure that the following switches on the G&N Indicator Control Panel are set as follows:

- a. TELESCOPE TRUNNION to SLAVE to EXT
- b. CONTROLLER COUPLING to DIRECT
- c. CONTROLLER SPEED to HI
- d. OPTICS MODE to MAN

6.2.10.3 Monitor the Optics CDU's by entering VERB 16 NOUN 91 into K-148. Press the ENTER pushbutton.

6.2.10.4 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Verify the Optics have zeroed properly by observing the following on R1 and R2 of the CRT.

- a. R1 = +0.00° +0.02°, -0.03° (Shaft Angle)
- b. R2 = +0.000° +0.006°, -0.007° (Trunnion Los Angle)

6.2.10.4.1 Enter the following:

VERB 01      NOUN 10      ENTER  
 00033                      ENTER  
 Verify R1 = XXX6X

6.2.10.4.2 Set the OPTICS MODE switch to CMC. Enter the following:

ENTER  
 00033, ENTER  
 Verify R1 = XXX5X

#### OPTICS TIME TO ZERO TEST

6.2.10.5 Deleted.

6.2.10.6 Deleted.

6.2.10.7 Deleted.

6.2.10.8 Deleted.

6.2.10.9 Deleted.

6.2.10.10 Deleted.

6.2.10.11 Deleted.

6.2.10.12 Insert the Inflight Tool (V30001400) into the Trunnion Tool input and engage drive mechanism (bottom out). Verify that the trunnion turns by viewing the movement through the SCT eyepiece while turning the tool until the TPAC reads +5°. Remove the tool from the trunnion tool input.

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6.2.10.13 Insert the Inflight Tool (V3601405) into the Shaft Tool Input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to -3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool.

6.2.10.14 Insert the Inflight Tool (V3601405) into the Trunnion Tool Input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool.

6.2.11 OPTICS Coordinate Transformation Control Test.

6.2.11.1 Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.

NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding.

#### INITIALIZATION

6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.

- TELESCOPE TRUNNION to SLAVE to EXT
- CONTROLLER COUPLING to DIRECT
- CONTROLLER SPEED to HI
- OPTICS MODE to MAN

6.2.11.3 Enter the following into the K-Start:

VERB 16 NOUN 91 ENTR

6.2.11.4 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS MODE switch to MAN.

6.2.11.5 Set up the analog recorders to monitor the following measurements.

- CG 3170 SCT Trunnion Tachometer Output

#### RESOLVED MODE PHASING AND IMAGE RATE TEST

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- 6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until R1 = +225.00 and R2 = +10.000 on the CRT and the DSKY's.
- 6.2.11.7 Set the CONTROLLER COUPLING switch on the G&N Panel to RSLV and the CONTROLLER SPEED switch to MED.
- 6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.
- 6.2.11.9 Record time.. Quickly displace the OPTICS CONTROL STICK 45±10 degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at 45±10 degrees. When target leaves the SCT upper right field of view press MARK pushbutton. The PROG alarm light shall light.
- 6.2.11.10 From the uplink file tape, the compressed data tape, or the PCM tape request a data reduction of the shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) and the PROG alarm discrete for the period during which the OPTICS CONTROL STICK was being displaced above. The shaft CDU angle shall be 225±10.00 degrees at the time the PROG alarm occurred. The elapsed time from time of OPTICS CONTROL STICK displacement to the time the PROG alarm discrete is obtained shall be 19 to 32 seconds.
- CSC AMPLIFIER SHAFT AND TRUNNION DRIVE TEST
- 6.2.11.11 Set the CONTROLLER COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the Optics until R1 = +225.00 and R2 = +10.000. Set the CONTROLLER COUPLING switch to RSLV.
- 6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.
- 6.2.11.13 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the CONTROLLER COUPLING switch on the G&N Panel to DIRECT. Set the OPTICS MODE switch to ZERO. After 15 seconds, return the switch to MAN.

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6.2.12.3 Deleted.

6.2.12.4 Insure that the Optics Control switches on the G&N Indicator Control Panel are set as follows:

- a. OPTICS MODE to MAN
- b. CONTROLLER SPEED to LO
- c. CONTROLLER COUPLING to DIRECT
- d. TELESCOPE TRUNNION to SLAVE to SXT

6.2.12.5 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN.

6.2.12.6 Resolution Checks

6.2.12.6.1 SXT Resolution Check - M80 only.

6.2.12.6.1.1 Sight through the SXT eyepiece. Using the OPTICS CONTROL STICK, adjust the SXT to obtain the best reflected field of view of the 5-inch autocollimator reticle engravings at the center of view.

6.2.12.6.1.2 Note that the autocollimator reticle contains a series of lines of different thickness and width. Each set of lines is marked with a number (20, 15, 10, 7, 5, 3) which indicates the angle subtended by one line and one space. View each set of lines to determine the lowest numbered set in which resolution between lines (ability to distinguish separate distinct lines within a set) can be made. Record the number associated with that set of lines. The SXT resolution shall be at least 10 arc seconds at the center of the field of view.

6.2.12.6.2 SCT Resolution Check

6.2.12.6.2.1 Sight through the SCT EYEPIECE. Using the OPTICS CONTROL STICK adjust the SCT to obtain the best view of the SCT RESOLUTION CHART held in the Optics line of sight.

6.2.12.6.2.2 Note the chart contains sets of lines. View each set of lines to determine the lowest numbered set in which the resolution between lines (ability to distinguish separate lines within a set) can be made. The SCT shall have a resolution of at least 3 arc minutes at the center of the field of view.

6.2.12.7 Slave Telescope Mode Checks

6.2.12.7.1 Verify/perform OPTICS POWER ON TEST per paragraph 6.2.3.2.

6.2.12.7.2 Set/Verify following switches on G&N INDICATOR CONTROL PANEL:

- a. TELESCOPE TRUNNION - SLAVE to SXT
- b. CONTROLLER COUPLING - DIRECT
- c. CONTROLLER SPEED - HI

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- 6.2.12.7.3 Monitor OCDU's by entering VERB 16 NOUN 91 into K-148. Press ENTER.
- 6.2.12.7.4 Set OPTICS MODE to MAN
- 6.2.12.7.5 Using the Optics Hand Controller drive the optics until:  
R1 = +010.00±001.00 (SHAFT)  
R2 = +10.000±01.000 (TRUNNION)
- 6.2.12.7.6 Verify on the CRT and Optics Panel:  
SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.7 Set the TELESCOPE TRUNNION on the G&N INDICATOR CONTROL PANEL to 0°.
- 6.2.12.7.8 Verify:  
SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = 0.0° ±0.22 DEG  
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.9 Set the TELESCOPE TRUNNION on the G&N INDICATOR CONTROL PANEL to OFFSET 25°.
- 6.2.12.7.10 Verify on CRT and Optics Panel:  
SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = 25° ±1.00 DEG  
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.11 On the G&N INDICATOR CONTROL PANEL set the TELESCOPE TRUNNION to SLAVE to EXT.
- 6.2.12.7.12 Verify on CRT and Optics Panel:  
SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.13 CAUTION: Set Paragraph 5.1.2.11 before proceeding. On the G&N INDICATOR CONTROL PANEL set the OPTICS MODE to ZERO. Wait 15 seconds.
- 6.2.12.7.14 Verify on CRT and OPTICS PANEL:  
R1 = 000.00 +000.00, -000.03  
R2 = 00.000 +00.000, -00.007°  
SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.15 If Optics testing will not be continued, set the G&N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.8 EXT Parallelism Tests

- 6.2.12.8.1 Remove the plug from the base of the EXT eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light.

NOTE: If needed to reduce external light, place a photographer's hood over the optics head.

- 6.2.12.8.2 EXT Auto Collimator Parallelism Test - MSO only

- 6.2.12.8.2.1 Using the OPTICS CONTROL STICK drive the EXT S&LOS Trunnion to  $+15.00^{\circ} \pm 2^{\circ}$  as indicated in R2 of the DSKY. Maintain a Shaft CDU angle of  $000.00 \pm 0.10$  degree.

- 6.2.12.8.2.2 Sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to superimpose the EXT L&LOS horizontal reticle image upon the autocollimator horizontal filar. Record the autocollimator reading.

- 6.2.12.8.2.3 Repeat 6.2.12.8.2.2 twice. Calculate and record the average of the three autocollimator readings.

- 6.2.12.8.2.4 Set the OPTICS MODE switch to ZERO. After 15 seconds return the OPTICS MODE switch to MAN.

- 6.2.12.8.2.5 Again sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to bring the EXT S&LOS horizontal reticle and autocollimator horizontal filar images to coincide. Record the autocollimator reading.

- 6.2.12.8.2.6 Repeat 6.2.12.8.2.5 twice. Calculate and record the average of the three autocollimator readings. The average value obtained here shall not differ from that obtained in 6.2.12.8.2.3 by more than 10 arc seconds.

- 6.2.12.8.3 Deleted.

- 6.2.12.8.3.1 Deleted.

- 6.2.12.8.3.2 Deleted.

- 6.2.12.8.3.3 Deleted.
- 6.2.12.8.3.4 Deleted.
- 6.2.12.9 SXT, CMC FUNCTION CHECK
- 6.2.12.9.1 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch to ZERO. After 15 seconds,  
return the switch to MAN.
- 6.2.12.9.2 Sight through the SXT. Using the Control Stick align the  
SXT SLOS with Optical Target No. 1.
- 6.2.12.9.3 When aligned record the value of Shaft and Trunnion CDU's  
from the CRT.
- 6.2.12.9.4 Sight through the SXT. Using the Control Stick align the  
SXT SLOS with Optical Target No. 2.
- 6.2.12.9.5 When aligned, record the value of Shaft and Trunnion CDU's  
from the CRT.
- 6.2.12.9.6 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch on the G&N Indicator Control  
Panel to ZERO. After 15 seconds set the switch to MAN,  
then CMC.
- 6.2.12.9.7 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the  
value for Shaft from 6.2.12.9.3 into the DSKY and press ENTER.  
Enter the value for Trunnion from 6.2.12.9.3 into the DSKY  
and press ENTER.
- 6.2.12.9.8 Sight through the SXT. The SLOS should be approximately  
centered on the Optical Target No. 1. Record the value of  
Shaft and Trunnion CDU's from the CRT. The difference  
between these values and the corresponding values recorded  
in 6.2.12.9.3 shall be less than 0.06 degree for the Shaft  
and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.9 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the  
value for Shaft from 6.2.12.9.5 into the DSKY and press the  
ENTER pushbutton. Enter the value for Trunnion from  
6.2.12.9.5 into the DSKY and press the ENTER pushbutton.



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| 6.2.12.9.10                                   | Sight through the SXT. The SLOS should be approximately centered on the Optical Target No. 2. Press the MARK push-button and record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.                                                                                                                                                                                                                                              |         |             |                                        |                    |                                        |                       |                                               |                         |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------|----------------------------------------|--------------------|----------------------------------------|-----------------------|-----------------------------------------------|-------------------------|
| 6.2.12.9.11                                   | CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |             |                                        |                    |                                        |                       |                                               |                         |
| 6.2.12.9.12                                   | If OPTICS testing will not continue, set the G&N Power Optics Switch on the LEB Lighting Panel to OFF.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |             |                                        |                    |                                        |                       |                                               |                         |
| Change 15                                     | Replace Section 6.2.13 with the following:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |             |                                        |                    |                                        |                       |                                               |                         |
| 6.2.13                                        | Optics Slew Rate Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |             |                                        |                    |                                        |                       |                                               |                         |
| 6.2.13.1                                      | Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following signals on the CRT. <ul style="list-style-type: none"> <li>a. +28 VDC OPTICS OPERATE BUS (CG 1530) is <math>+28.0 \pm 3.0</math> VDC.</li> <li>b. OPTX 28V 800 cps 1% 0° ph not flashing on the CRT</li> <li>c. OPTX 28V 800 cps 5% -90° not flashing on the CRT</li> </ul>                                                                                                                                                                                                                                                 |         |             |                                        |                    |                                        |                       |                                               |                         |
| 6.2.13.1.1                                    | Verify and/or set the following switches on the G&N Indicator Control Panel to the positions indicated. <ul style="list-style-type: none"> <li>a. TELESCOPE TRUNNION to SLAVE to SXT</li> <li>b. CONTROLLER COUPLING to DIRECT</li> <li>c. CONTROLLER SPEED to HI</li> <li>d. OPTICS MODE to MAN</li> <li>e. TRACKER to OFF</li> </ul>                                                                                                                                                                                                                                                                                               |         |             |                                        |                    |                                        |                       |                                               |                         |
| 6.2.13.2                                      | Monitor the OCDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton. Insure RECORD DSKY and RECORD DOWNLINK of R-145 are on.<br><br>TRUNNION SLEW RATE - HIGH SPEED                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |             |                                        |                    |                                        |                       |                                               |                         |
| 6.2.13.3                                      | CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS MODE switch on the G&N Indicator Panel to MAN.                                                                                                                                                                                                                                                                                                                                                                                                                             |         |             |                                        |                    |                                        |                       |                                               |                         |
| 6.2.13.3.1                                    | During the Trunnion Slew Rate Test monitor and verify the following signals: <table> <tr> <th>Signals</th><th>Requirement</th></tr> <tr> <td>a. SXT TRUNNION TACH O/P (CG 3150), FQ</td><td><math>3.3 \pm 1.3</math> VRMS</td></tr> <tr> <td>b. SCT TRUNNION TACH O/P (CG 3170), FQ</td><td><math>-0.85 \pm 0.35</math> VRMS</td></tr> <tr> <td>c. SCT Trunnion Servo Error in Phase (CG3118)</td><td><math>-0.25</math> to <math>-2.00</math> VRMS</td></tr> </table> <p>NOTE: Read and understand 6.2.13.4 before proceeding. Do not hold Control Stick at upper limit more than 10 seconds or exceed a trunnion angle of 85°.</p> | Signals | Requirement | a. SXT TRUNNION TACH O/P (CG 3150), FQ | $3.3 \pm 1.3$ VRMS | b. SCT TRUNNION TACH O/P (CG 3170), FQ | $-0.85 \pm 0.35$ VRMS | c. SCT Trunnion Servo Error in Phase (CG3118) | $-0.25$ to $-2.00$ VRMS |
| Signals                                       | Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |             |                                        |                    |                                        |                       |                                               |                         |
| a. SXT TRUNNION TACH O/P (CG 3150), FQ        | $3.3 \pm 1.3$ VRMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |         |             |                                        |                    |                                        |                       |                                               |                         |
| b. SCT TRUNNION TACH O/P (CG 3170), FQ        | $-0.85 \pm 0.35$ VRMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |             |                                        |                    |                                        |                       |                                               |                         |
| c. SCT Trunnion Servo Error in Phase (CG3118) | $-0.25$ to $-2.00$ VRMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |             |                                        |                    |                                        |                       |                                               |                         |

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6.2.13.4 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 7 seconds release the control stick.

6.2.13.5 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the slew rate test was being performed.

Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.

The Trunnion slew rate shall be  $10.0 \pm 2.0$  deg/sec.

SHAFT SLEW RATE - HI SPEED

6.2.13.6 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.

6.2.13.6.1 During the Shaft Slew Rate Test monitor and verify the following signals:

| Signal                                     | Requirement             |
|--------------------------------------------|-------------------------|
| a. SXT SHAFT TACH O/P (CG 3140), FQ        | $3.3 \pm 1.3$ VRMS      |
| b. SCT SHAFT TACH O/P (CG 3160), FQ        | $-3.3 \pm 1.3$ VRMS     |
| c. SXT Shaft Servo Error inphase (CG 3117) | $-0.25$ to $-2.00$ VRMS |

NOTE: Read and understand step 6.2.13.7 before proceeding.  
Do not hold Control Stick at right limit for more than 10 seconds or exceed a shaft angle of  $250^\circ$ .

6.2.13.7 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 7 seconds release the control stick.

6.2.13.8 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the slew rate test was being performed.

Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.

The Shaft slew rate shall be  $19.5 \pm 3.9$  deg/sec.

TRUNNION SLEW RATE - MED SPEED.

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- 6.2.13.9 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the OPTICS CONTROLLER SPEED switch to MED.
- NOTE: Read and understand 6.2.13.10 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.
- 6.2.13.10 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.
- Record the EXT TRUN MTR Control Winding (CG 3155) and EXT TRUN TACH (CG 3156) signals while slowing the Optics. CG 3155 shall be  $\pm 0.25$  to  $\pm 2.00$  VRMS. CG 3156 shall be  $\pm 0.33 \pm 0.13$  VRMS.
- 6.2.13.11 Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU registers (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the  $\Delta$  CDU angle by the elapsed time.
- The Trunnion slew rate shall be  $1.0 \pm 0.2$  deg/sec.
- SHAFT SLEW RATE - MED SPEED
- 6.2.13.12 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set OPTICS MODE switch to MAN.
- NOTE: Read and understand 6.2.13.13 before proceeding. Do not hold control stick at the right limit for more than 20 seconds.
- 6.2.13.13 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.
- Record the EXT SHAFT MTR Control Winding (CG 3145) and EXT Shaft Tach (CG 3146) signals while slowing the Optics. CG 3145 shall be  $\pm 0.50$  to  $\pm 4.00$  VRMS. CG 3146 shall be  $0.33 \pm 0.13$  VRMS.
- 6.2.13.14 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) for the 12 second period during which the rate test was being performed.

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Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.

The Shaft slew rate shall be  $2.0 \pm 0.4$  deg/sec.

TRUNNION SLEW RATE - LO SPEED

6.2.13.15 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the  
OPTICS MODE switch to MAN. Set the CONTROLLER SPEED  
switch to LO.

6.2.13.15.1 During the Trunnion Slew Rate Test monitor and verify the  
following signals:

| Signal                                | Requirement            |
|---------------------------------------|------------------------|
| a. TRUNNION CDU FINE ERROR (CG 3001), | FQ $\pm 0.07$ VRMS MAX |

NOTE: Read and understand 6.2.13.16 before proceeding. Do  
not hold control stick at upper limit for more than 20  
seconds.

6.2.13.16 Record time. Push and hold the Optics Control Stick to its upper  
limit. After approximately 12 seconds release the control stick.

6.2.13.17 Perform the following calculations:

From the uplink file tape the compressed data tape or the PCM  
tape request a data reduction of the Trunnion CDU register (address  
36) and the TIME 2 and TIME 1 registers (addresses 24 and 25  
respectively) for the 12 second period during which the slew rate  
test was being performed.

Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.

The Trunnion Slew Rate shall be  $0.10 \pm 0.02$  deg/sec.

SHAFT SLEW RATE - LO SPEED

6.2.13.18 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the  
OPTICS MODE switch to MAN.

6.2.13.18.1 During the Shaft Slew Rate test monitor and verify the following  
signal:

| Signal                            | Requirement            |
|-----------------------------------|------------------------|
| a. SHAFT CDU FINE ERROR (CG 3021) | FQ $\pm 0.07$ VRMS MAX |

NOTE: Read and understand 6.2.13.19 before proceeding. Do not  
hold control stick at right limit for more than 20 seconds.

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- 6.2.13.19 Record time. Push and hold the Optics Control stick to its right limit. After approximately 12 seconds release the control stick.
- 6.2.13.20 Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the slew rate test was being performed.
- Calculate the rate by dividing the  $\Delta$  CDU angle by the elapsed time.
- The Shaft Slew Rate shall be  $0.20 \pm 0.04$  deg/sec.
- OPTICS HAND CONTROLL<sup>FR</sup> DRIFT RATE CHECK - LO SPEED
- 6.2.13.21 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Record time. Wait 60 seconds.
- 6.2.13.22 Perform the following calculations:
- From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the Trunnion and Shaft CDU registers (addresses 35 and 36 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 60 second period during which the drift rate test was being performed.
- Calculate the drift rates by dividing the  $\Delta$  CDU angle by the elapsed time.
- The Trunnion drift rate shall be less than .0167 deg/sec.
- The Shaft drift rate shall be less than .0433 deg/sec.
- 6.2.13.23 If OPTICS testing will not continue, set the G/N Power-Optics switch on the LEB Lighting Control Panel to OFF.
- Change 16 Replace Paragraph 6.2.17.5 with the following:
- 6.2.17.5 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
On the G&N Indicator Control Panel set the following switches to the position indicated.
- TELESCOPE TRUNNION to SLAVE to EXT
  - CONTROLLER COUPLING to DIRECT
  - CONTROLLER SPEED to LO
  - OPTICS MODE to ZERO.

Change 17 Replace paragraph 6.2.17.20 with the following:

6.2.17.20 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. After 18 seconds return the switch to MAN. Enter VERB 33, ENTER into the DSKY.

Change 18 Replace paragraphs 6.2.18.8.1, 6.2.18.8.11, 6.2.18.8.12 and 6.2.18.8.14 with the following:

6.2.18.8.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. After 240 minutes from T<sub>0</sub>, set the OPTICS MODE switch to ZERO.

6.2.18.8.11 Set the CONTROLLER SPEED switch to HI. Using the Optics Hand Controller, drive the EXT SLOS to the approximate position of Target 2.

6.2.18.8.12 Set the CONTROLLER SPEED switch to LO. Using the Optics Hand Controller, align the EXT SLOS to Target 2 and press the MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied, press the MARK REJECT pushbutton and repeat this step.

6.2.18.8.14 CAUTION: See Paragraph 5.1.2.11 before proceeding. Enter VERB 34, ENTER into the DSKY. Observe the PROGRAM display change to 02. Set the Optics Mode Switch on the G&N Indicator Control Panel to ZERO.

Change 19 Replace paragraphs 6.2.20.3.2, 6.2.20.3.22, and 6.2.20.3.29 and replace with the following:

6.2.20.3.2 Set the OPTICS MODE selector on the Indicator Control panel to MAN.

6.2.20.3.22 Set the OPTICS CONTROLLER SPEED switch on the Indicator Control Panel to HI.

6.2.20.3.29 Set the OPTICS MODE switch on the Indicator Control panel to ZERO for 30 seconds then return to MAN.

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 Class A Release

POST INSTALLATION CHECKOUT PROCESS  
 SPECIFICATION FOR THE APOLLO GUIDANCE &  
 NAVIGATION SYSTEM BLOCK II-KSC

Record of Revisions

| Date    | Revision Letter | TDR No. | Pages Revised                                                                                                                                                 | Approval |
|---------|-----------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 9/11/67 | A               | 33750   | 10-12, 15, 24, 35-45, 51-55, 58-67, 72-73, 81, 82, 84-86, 91, 95-97, 99-102, 105-119. Was 119 pages, now 120. <i>9/11/67</i>                                  | EA       |
| 9/29/67 | B               | 34782   | 2-128; Specification was 128 pages, now 129 <i>9/29/67</i>                                                                                                    | EA       |
| 1/16/68 | C               | 35445   | Completely revised. Specification was 129 pages, now 174 pages. <i>1/16/68</i>                                                                                | EA       |
| 1/23/68 | D               | 35470   | 8, 22, 27, 43, 63, 64, 68, 78, 108, 109, 111, 127, 163, 164 <i>1/23/68</i>                                                                                    | EA       |
| 2/23/68 | E               | 35753   | 2, 17, 21, 23, 25, 27-32, 43, 46-53, 59, 62, 63, 65, 72, 73, 76-78, 82, 83, 85, 86, 88, 89, 96, 100, 103, 108, 109, 141, 142, 161-164, 171-174 <i>2/23/68</i> | EA WLS   |
| 3/24/68 | F               | 36254   | 2, 7, 8, 11, 17, 24, 25, 35, 37, 39-42, 53, 55, 60-62, 64-75, 83, 85, 86, 91, 100, 103, 108, 110, 111, 125, 126, 159-163, 165-174 <i>3/24/68</i>              | EA WLS   |
| 7/19/68 | G               | 36563   | 2-174. Retyped. Was 174 pages; now 144 pages. <i>7/19/68</i>                                                                                                  | EA WLS   |

APPROVALS

NASA/MSC

*10/1/68*

*10/1/68*

3.1.2

The following addendums are applicable to this document.

- a. Deleted
- b. Addendum II, Colossus G&N System Tests
- c. Addendum III, CSM 101.



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- 5.1.2.6 The interruption of +28 VDC power to the G&N System through the Main A and Main B power busses shall be cause for the Command Module G&N System operator to immediately initiate the Emergency shutdown procedure (6.1.4) to preclude damage to the G&N System.
- 5.1.2.7 The SCT and SXT eyepieces shall be stowed whenever the instruments are not in use to preclude damage to them. It shall be necessary to install the eyepieces when testing requires use of the instrument.
- 5.1.2.8 To preserve the operational life of the components of the MDC and LEB DSKY's, the monitor routines shall be used only when required by test procedure or trouble shooting. Such routines shall be terminated as quickly as possible in the test flow. Computer routines which cause the DSKY display to flash (either requesting data or displaying data) shall also be terminated as quickly as possible.
- 5.1.2.9 To reduce the possibility of the optics drifting into the stops, place the optics in the ZERO mode whenever the optics is to be on and not used for any appreciable time.
- 5.1.2.10 Avoid repeated slewing of SXT Shaft and Trunnion into the mechanical stops.
- 5.1.2.11 Prior to performing a ZERO OPTICS, the SXT Trunnion shall be carefully slewed to within +10 degrees of zero as indicated by the TPAC (Telescope Trunnion slaved to SXT). In no event shall the OPTICS by ZEROED from angles greater than +10 degrees on Trunnion.
- 5.2 Standard Environmental Conditions
- 5.2.1 The G&N System when installed in the Command Module shall be tested in an environment in accordance with ICD MH01-1348-416. Dust covers shall be installed on the SXT and SCT per ICD MH01-01350-116 when optics are not under test.
- 5.2.1.1 For periods of G&N Testing with the optical heads and the eyepieces of the SCT and SXT of the C/M G&N uncovered, or with the eyepieces removed, the environment shall meet at least the Class 100,000 particle size and count.
- 5.2.1.2 With the optical heads covered and the eyepieces installed or covered on the optical components (SXT, SCT), the ambient environment shall meet the following conditions for particle size and count. No more than 1,400 particles 5.0 microns or larger per cubic foot.
- 5.2.2 The APOLLO G&N System shall interface with a qualified ECS distribution system which shall supply coolant fluid during STANDBY and OPERATE control modes with flow rates and inlet temperatures as specified in ICD MH01-01349-416.
- 5.3 Test Equipment Tolerances

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5.3.1 Measurements and tolerances as stated herein are basic G&N System performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. PSAAM and Signal Conditioner stability uncertainties are included in Appendix L.

5.4 Test Sequence

5.4.1 The test sequence should follow the flow chart of Figure 1, except for 6.2.5, Turn-On and Turn-Off procedure, which may be performed as the requirement arises.

TABLE I

| Paragraph No. | Test Title                                    |
|---------------|-----------------------------------------------|
| 6.2.1         | Application of Standby Power to G&N System    |
| 6.2.2         | CMC Operational Test                          |
| 6.2.3         | Operate Power On Test                         |
| 6.2.4         | G&N Power Supplies Test                       |
| 6.2.5         | General Turn Off and Turn On Procedures       |
| 6.2.6         | G&N Operational Test                          |
| 6.2.7         | Gimbal Friction Test                          |
| 6.2.8         | G&N Panel Brightness & Lamp Test              |
| 6.2.9         | Semi-Automatic Mode Control Test              |
| 6.2.10        | Zero Optics Test                              |
| 6.2.11        | Optics Coordinate Transformation Control Test |
| 6.2.12        | Optics Function Test - VAB and PAD            |
| 6.2.13        | Optics Slew Rate Test                         |
| 6.2.14        | Stabilization Loop Step Response Test         |
| 6.2.15        | IRIG Scale Factor Test                        |
| 6.2.16        | IMU Performance Test                          |
| 6.2.17        | Fine Alignment Test SXT-NB-IMU                |
| 6.2.18        | Gyrocompassing Test                           |
| 6.2.19        | Voltage Margin Test                           |
| 6.2.20        | S/C Control & Display Test                    |

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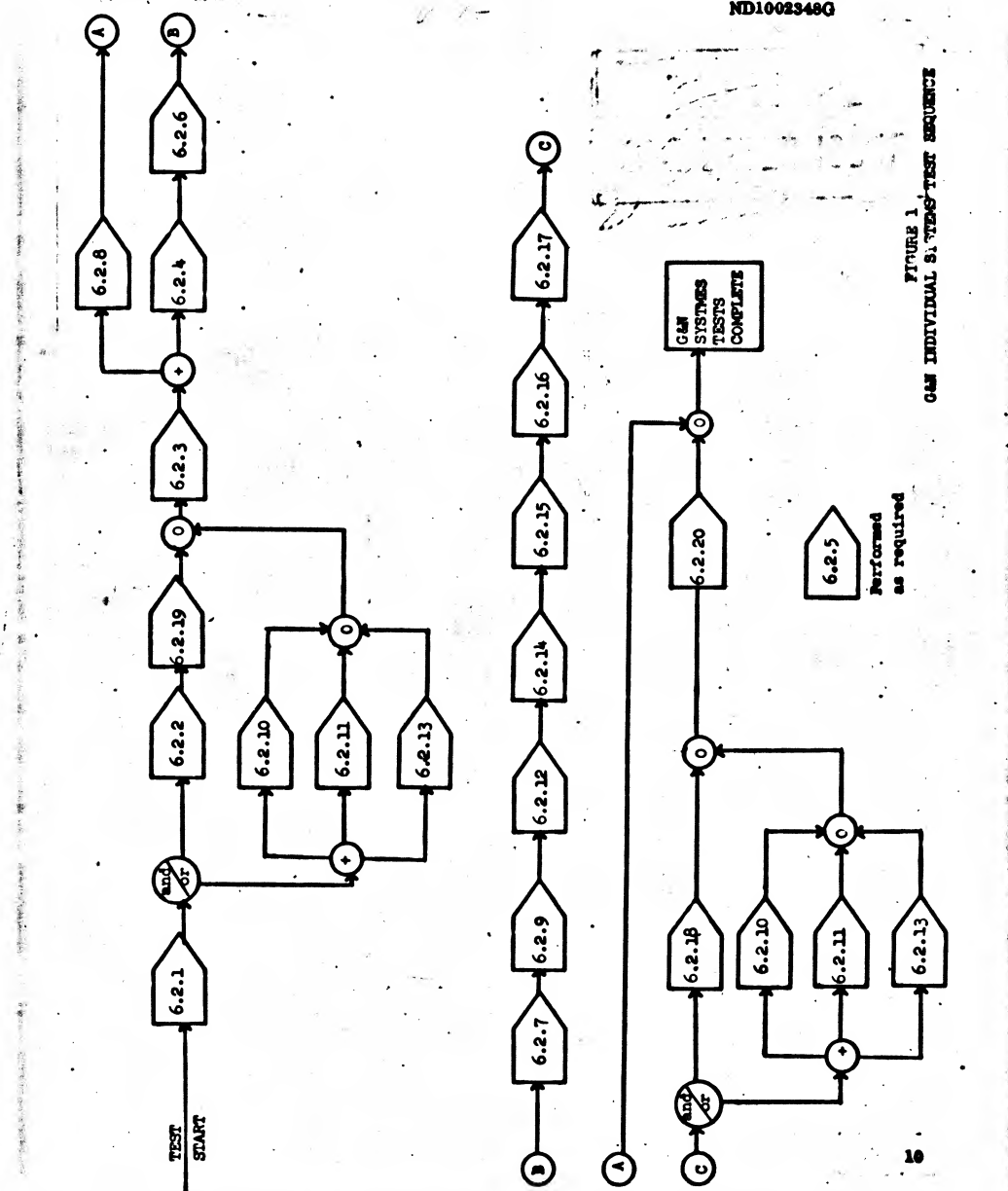


FIGURE 1  
GAN INDIVIDUAL S-TEST SEQUENCE

5.4.2 Failure of the D criteria for IRIG and PIPA parameters.

5.4.2.1 If  $D_1$ ,  $D_2$ , or  $D_3$  exceeds its maximum value as specified in Table D, Paragraph 6.2.16.10.8 for any IRIG or PIPA, a retest sequence shall be initiated as indicated below:



The retest sequence shall be performed using the paragraphs indicated in Table I corresponding to the out-of-spec parameters. Table 2 indicates the test positions and other isolated parameters that must be recalculated and qualified.

If  $D_1$ ,  $D_2$ , or  $D_3$  exceeds its maximum value after the retest sequence is completed, the requirements of 5.4.2.2 (IRIG) or 5.4.2.3 (PIPA) shall apply. If  $D_1$ ,  $D_2$ , and  $D_3$  are within tolerances specified in Table D after the retest sequence is completed, the original out-of-tolerance D terms calculated in paragraph 6.2.16.10.8 shall be exonerated.

5.4.2.2 IRIG stability requirements.

5.4.2.2.1 Failure to be within the maximum values for  $D_1$  or  $D_2$  or  $D_3$  after the retest sequence shall constitute failure of the unit.

5.4.2.3 PIPA stability requirements.

5.4.2.3.1 Failure to be within the maximum limits of  $D_1$  or  $D_2$  or  $D_3$  after the retest sequence constitute failure of the unit.

5.4.2.3.2 If authority has been obtained to degauss a PIPA, then data taken prior to the degaussing of that PIPA, shall not be used in the future to calculate stability terms. After degaussing, the retest sequence of Paragraph 5.4.2.1 must be performed.

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| O.D. PARAMETERS |  | PARAMETER VALUES |  | C.S. 16, 17, 18 where 1 is 16 and 18 is 17 |  | C.S. 19, 20 where 1 is 19 and 20 is 20 |  | C.S. 21, 22 where 1 is 21 and 22 is 22 |  | C.S. 23, 24 where 1 is 23 and 24 is 24 |  | C.S. 25, 26 where 1 is 25 and 26 is 26 |  | C.S. 27, 28 where 1 is 27 and 28 is 28 |  | C.S. 29, 30 where 1 is 29 and 30 is 30 |  | C.S. 31, 32 where 1 is 31 and 32 is 32 |  | C.S. 33, 34 where 1 is 33 and 34 is 34 |  | C.S. 35, 36 where 1 is 35 and 36 is 36 |  | C.S. 37, 38 where 1 is 37 and 38 is 38 |  | C.S. 39, 40 where 1 is 39 and 40 is 40 |  | C.S. 41, 42 where 1 is 41 and 42 is 42 |  | C.S. 43, 44 where 1 is 43 and 44 is 44 |  | C.S. 45, 46 where 1 is 45 and 46 is 46 |  | C.S. 47, 48 where 1 is 47 and 48 is 48 |  | C.S. 49, 50 where 1 is 49 and 50 is 50 |  | C.S. 51, 52 where 1 is 51 and 52 is 52 |  | C.S. 53, 54 where 1 is 53 and 54 is 54 |  | C.S. 55, 56 where 1 is 55 and 56 is 56 |  | C.S. 57, 58 where 1 is 57 and 58 is 58 |  | C.S. 59, 60 where 1 is 59 and 60 is 60 |  | C.S. 61, 62 where 1 is 61 and 62 is 62 |  | C.S. 63, 64 where 1 is 63 and 64 is 64 |  | C.S. 65, 66 where 1 is 65 and 66 is 66 |  | C.S. 67, 68 where 1 is 67 and 68 is 68 |  | C.S. 69, 70 where 1 is 69 and 70 is 70 |  | C.S. 71, 72 where 1 is 71 and 72 is 72 |  | C.S. 73, 74 where 1 is 73 and 74 is 74 |  | C.S. 75, 76 where 1 is 75 and 76 is 76 |  | C.S. 77, 78 where 1 is 77 and 78 is 78 |  | C.S. 79, 80 where 1 is 79 and 80 is 80 |  | C.S. 81, 82 where 1 is 81 and 82 is 82 |  | C.S. 83, 84 where 1 is 83 and 84 is 84 |  | C.S. 85, 86 where 1 is 85 and 86 is 86 |  | C.S. 87, 88 where 1 is 87 and 88 is 88 |  | C.S. 89, 90 where 1 is 89 and 90 is 90 |  | C.S. 91, 92 where 1 is 91 and 92 is 92 |  | C.S. 93, 94 where 1 is 93 and 94 is 94 |  | C.S. 95, 96 where 1 is 95 and 96 is 96 |  | C.S. 97, 98 where 1 is 97 and 98 is 98 |  | C.S. 99, 100 where 1 is 99 and 100 is 100 |  | C.S. 101, 102 where 1 is 101 and 102 is 102 |  | C.S. 103, 104 where 1 is 103 and 104 is 104 |  | C.S. 105, 106 where 1 is 105 and 106 is 106 |  | C.S. 107, 108 where 1 is 107 and 108 is 108 |  | C.S. 109, 110 where 1 is 109 and 110 is 110 |  | C.S. 111, 112 where 1 is 111 and 112 is 112 |  | C.S. 113, 114 where 1 is 113 and 114 is 114 |  | C.S. 115, 116 where 1 is 115 and 116 is 116 |  | C.S. 117, 118 where 1 is 117 and 118 is 118 |  | C.S. 119, 120 where 1 is 119 and 120 is 120 |  | C.S. 121, 122 where 1 is 121 and 122 is 122 |  | C.S. 123, 124 where 1 is 123 and 124 is 124 |  | C.S. 125, 126 where 1 is 125 and 126 is 126 |  | C.S. 127, 128 where 1 is 127 and 128 is 128 |  | C.S. 129, 130 where 1 is 129 and 130 is 130 |  | C.S. 131, 132 where 1 is 131 and 132 is 132 |  | C.S. 133, 134 where 1 is 133 and 134 is 134 |  | C.S. 135, 136 where 1 is 135 and 136 is 136 |  | C.S. 137, 138 where 1 is 137 and 138 is 138 |  | C.S. 139, 140 where 1 is 139 and 140 is 140 |  | C.S. 141, 142 where 1 is 141 and 142 is 142 |  | C.S. 143, 144 where 1 is 143 and 144 is 144 |  | C.S. 145, 146 where 1 is 145 and 146 is 146 |  | C.S. 147, 148 where 1 is 147 and 148 is 148 |  | C.S. 149, 150 where 1 is 149 and 150 is 150 |  | C.S. 151, 152 where 1 is 151 and 152 is 152 |  | C.S. 153, 154 where 1 is 153 and 154 is 154 |  | C.S. 155, 156 where 1 is 155 and 156 is 156 |  | C.S. 157, 158 where 1 is 157 and 158 is 158 |  | C.S. 159, 160 where 1 is 159 and 160 is 160 |  | C.S. 161, 162 where 1 is 161 and 162 is 162 |  | C.S. 163, 164 where 1 is 163 and 164 is 164 |  | C.S. 165, 166 where 1 is 165 and 166 is 166 |  | C.S. 167, 168 where 1 is 167 and 168 is 168 |  | C.S. 169, 170 where 1 is 169 and 170 is 170 |  | C.S. 171, 172 where 1 is 171 and 172 is 172 |  | C.S. 173, 174 where 1 is 173 and 174 is 174 |  | C.S. 175, 176 where 1 is 175 and 176 is 176 |  | C.S. 177, 178 where 1 is 177 and 178 is 178 |  | C.S. 179, 180 where 1 is 179 and 180 is 180 |  | C.S. 181, 182 where 1 is 181 and 182 is 182 |  | C.S. 183, 184 where 1 is 183 and 184 is 184 |  | C.S. 185, 186 where 1 is 185 and 186 is 186 |  | C.S. 187, 188 where 1 is 187 and 188 is 188 |  | C.S. 189, 190 where 1 is 189 and 190 is 190 |  | C.S. 191, 192 where 1 is 191 and 192 is 192 |  | C.S. 193, 194 where 1 is 193 and 194 is 194 |  | C.S. 195, 196 where 1 is 195 and 196 is 196 |  | C.S. 197, 198 where 1 is 197 and 198 is 198 |  | C.S. 199, 200 where 1 is 199 and 200 is 200 |  | C.S. 201, 202 where 1 is 201 and 202 is 202 |  | C.S. 203, 204 where 1 is 203 and 204 is 204 |  | C.S. 205, 206 where 1 is 205 and 206 is 206 |  | C.S. 207, 208 where 1 is 207 and 208 is 208 |  | C.S. 209, 210 where 1 is 209 and 210 is 210 |  | C.S. 211, 212 where 1 is 211 and 212 is 212 |  | C.S. 213, 214 where 1 is 213 and 214 is 214 |  | C.S. 215, 216 where 1 is 215 and 216 is 216 |  | C.S. 217, 218 where 1 is 217 and 218 is 218 |  | C.S. 219, 220 where 1 is 219 and 220 is 220 |  | C.S. 221, 222 where 1 is 221 and 222 is 222 |  | C.S. 223, 224 where 1 is 223 and 224 is 224 |  | C.S. 225, 226 where 1 is 225 and 226 is 226 |  | C.S. 227, 228 where 1 is 227 and 228 is 228 |  | C.S. 229, 230 where 1 is 229 and 230 is 230 |  | C.S. 231, 232 where 1 is 231 and 232 is 232 |  | C.S. 233, 234 where 1 is 233 and 234 is 234 |  | C.S. 235, 236 where 1 is 235 and 236 is 236 |  | C.S. 237, 238 where 1 is 237 and 238 is 238 |  | C.S. 239, 240 where 1 is 239 and 240 is 240 |  | C.S. 241, 242 where 1 is 241 and 242 is 242 |  | C.S. 243, 244 where 1 is 243 and 244 is 244 |  | C.S. 245, 246 where 1 is 245 and 246 is 246 |  | C.S. 247, 248 where 1 is 247 and 248 is 248 |  | C.S. 249, 250 where 1 is 249 and 250 is 250 |  | C.S. 251, 252 where 1 is 251 and 252 is 252 |  | C.S. 253, 254 where 1 is 253 and 254 is 254 |  | C.S. 255, 256 where 1 is 255 and 256 is 256 |  | C.S. 257, 258 where 1 is 257 and 258 is 258 |  | C.S. 259, 260 where 1 is 259 and 260 is 260 |  | C.S. 261, 262 where 1 is 261 and 262 is 262 |  | C.S. 263, 264 where 1 is 263 and 264 is 264 |  | C.S. 265, 266 where 1 is 265 and 266 is 266 |  | C.S. 267, 268 where 1 is 267 and 268 is 268 |  | C.S. 269, 270 where 1 is 269 and 270 is 270 |  | C.S. 271, 272 where 1 is 271 and 272 is 272 |  | C.S. 273, 274 where 1 is 273 and 274 is 274 |  | C.S. 275, 276 where 1 is 275 and 276 is 276 |  | C.S. 277, 278 where 1 is 277 and 278 is 278 |  | C.S. 279, 280 where 1 is 279 and 280 is 280 |  | C.S. 281, 282 where 1 is 281 and 282 is 282 |  | C.S. 283, 284 where 1 is 283 and 284 is 284 |  | C.S. 285, 286 where 1 is 285 and 286 is 286 |  | C.S. 287, 288 where 1 is 287 and 288 is 288 |  | C.S. 289, 290 where 1 is 289 and 290 is 290 |  | C.S. 291, 292 where 1 is 291 and 292 is 292 |  | C.S. 293, 294 where 1 is 293 and 294 is 294 |  | C.S. 295, 296 where 1 is 295 and 296 is 296 |  | C.S. 297, 298 where 1 is 297 and 298 is 298 |  | C.S. 299, 300 where 1 is 299 and 300 is 300 |  | C.S. 301, 302 where 1 is 301 and 302 is 302 |  | C.S. 303, 304 where 1 is 303 and 304 is 304 |  | C.S. 305, 306 where 1 is 305 and 306 is 306 |  | C.S. 307, 308 where 1 is 307 and 308 is 308 |  | C.S. 309, 310 where 1 is 309 and 310 is 310 |  | C.S. 311, 312 where 1 is 311 and 312 is 312 |  | C.S. 313, 314 where 1 is 313 and 314 is 314 |  | C.S. 315, 316 where 1 is 315 and 316 is 316 |  | C.S. 317, 318 where 1 is 317 and 318 is 318 |  | C.S. 319, 320 where 1 is 319 and 320 is 320 |  | C.S. 321, 322 where 1 is 321 and 322 is 322 |  | C.S. 323, 324 where 1 is 323 and 324 is 324 |  | C.S. 325, 326 where 1 is 325 and 326 is 326 |  | C.S. 327, 328 where 1 is 327 and 328 is 328 |  | C.S. 329, 330 where 1 is 329 and 330 is 330 |  | C.S. 331, 332 where 1 is 331 and 332 is 332 |  | C.S. 333, 334 where 1 is 333 and 334 is 334 |  | C.S. 335, 336 where 1 is 335 and 336 is 336 |  | C.S. 337, 338 where 1 is 337 and 338 is 338 |  | C.S. 339, 340 where 1 is 339 and 340 is 340 |  | C.S. 341, 342 where 1 is 341 and 342 is 342 |  | C.S. 343, 344 where 1 is 343 and 344 is 344 |  | C.S. 345, 346 where 1 is 345 and 346 is 346 |  | C.S. 347, 348 where 1 is 347 and 348 is 348 |  | C.S. 349, 350 where 1 is 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472 is 472 |  | C.S. 473, 474 where 1 is 473 and 474 is 474 |  | C.S. 475, 476 where 1 is 475 and 476 is 476 |  | C.S. 477, 478 where 1 is 477 and 478 is 478 |  | C.S. 479, 480 where 1 is 479 and 480 is 480 |  | C.S. 481, 482 where 1 is 481 and 482 is 482 |  | C.S. 483, 484 where 1 is 483 and 484 is 484 |  | C.S. 485, 486 where 1 is 485 and 486 is 486 |  | C.S. 487, 488 where 1 is 487 and 488 is 488 |  | C.S. 489, 490 where 1 is 489 and 490 is 490 |  | C.S. 491, 492 where 1 is 491 and 492 is 492 |  | C.S. 493, 494 where 1 is 493 and 494 is 494 |  | C.S. 495, 496 where 1 is 495 and 496 is 496 |  | C.S. 497, 498 where 1 is 497 and 498 is 498 |  | C.S. 499, 500 where 1 is 499 and 500 is 500 |  | C.S. 501, 502 where 1 is 501 and 502 is 502 |  | C.S. 503, 504 where 1 is 503 and 504 is 504 |  | C.S. 505, 506 where 1 is 505 and 506 is 506 |  | C.S. 507, 508 where 1 is 507 and 508 is 508 |  | C.S. 509, 510 where 1 is 509 and 510 is 510 |  | C.S. 511, 512 where 1 is 511 and 512 is 512 |  | C.S. 513, 514 where 1 is 513 and 514 is 514 |  | C.S. 515, 516 where 1 is 515 and 516 is 516 |  | C.S. 517, 518 where 1 is 517 and 518 is 518 |  | C.S. 519, 520 where 1 is 519 and 520 is 520 |  | C.S. 521, 522 where 1 is 521 and 522 is 522 |  | C.S. 523, 524 where 1 is 523 and 524 is 524 |  | C.S. 525, 526 where 1 is 525 and 526 is 526 |  | C.S. 527, 528 where 1 is 527 and 528 is 528 |  | C.S. 529, 530 where 1 is 529 and 530 is 530 |  | C.S. 531, 532 where 1 is 531 and 532 is 532 |  | C.S. 533, 534 where 1 is 533 and 534 is 534 |  | C.S. 535, 536 where 1 is 535 and 536 is 536 |  | C.S. 537, 538 where 1 is 537 and 538 is 538 |  | C.S. 539, 540 where 1 is 539 and 540 is 540 |  | C.S. 541, 542 where 1 is 541 and 542 is 542 |  | C.S. 543, 544 where 1 is 543 and 544 is 544 |  | C.S. 545, 546 where 1 is 545 and 546 is 546 |  | C.S. 547, 548 where 1 is 547 and 548 is 548 |  | C.S. 549, 550 where 1 is 549 and 550 is 550 |  | C.S. 551, 552 where 1 is 551 and 552 is 552 |  | C.S. 553, 554 where 1 is 553 and 554 is 554 |  | C.S. 555, 556 where 1 is 555 and 556 is 556 |  | C.S. 557, 558 where 1 is 557 and 558 is 558 |  | C.S. 559, 560 where 1 is 559 and 560 is 560 |  | C.S. 561, 562 where 1 is 561 and 562 is 562 |  | C.S. 563, 564 where 1 is 563 and 564 is 564 |  | C.S. 565, 566 where 1 is 565 and 566 is 566 |  | C.S. 567, 568 where 1 is 567 and 568 is 568 |  | C.S. 569, 570 where 1 is 569 and 570 is 570 |  | C.S. 571, 572 where 1 is 571 and 572 is 572 |  | C.S. 573, 574 where 1 is 573 and 574 is 574 |  | C.S. 575, 576 where 1 is 575 and 576 is 576 |  | C.S. 577, 578 where 1 is 577 and 578 is 578 |  | C.S. 579, 580 where 1 is 579 and 580 is 580 |  | C.S. 581, 582 where 1 is 581 and 582 is 582 |  | C.S. 583, 584 where 1 is 583 and 584 is 584 |  | C.S. 585, 586 where 1 is 585 and 586 is 586 |  | C.S. 587, 588 where 1 is 587 and 588 is 588 |  | C.S. 589, 590 where 1 is 589 and 590 is 590 |  | C.S. 591, 592 where 1 is 591 and 592 is 592 |  | C.S. 593, 594 where 1 is 593 and 594 is 594 |  | C.S. 595, 596 where 1 is 595 and 596 is 596 |  | C.S. 597, 598 where 1 is 597 and 598 is 598 |  | C.S. 599, 600 where 1 is 599 and 600 is 600 |  | C.S. 601, 602 where 1 is 601 and 602 is 602 |  | C.S. 603, 604 where 1 is 603 and 604 is 604 |  | C.S. 605, 606 where 1 is 605 and 606 is 606 |  | C.S. 607, 608 where 1 is 607 and 608 is 608 |  | C.S. 609, 610 where 1 is 609 and 610 is 610 |  | C.S. 611, 612 where 1 is 611 and 612 is 612 |  | C.S. 613, 614 where 1 is 613 and 614 is 614 |  | C.S. 615, 616 where 1 is 615 and 616 is 616 |  | C.S. 617, 618 where 1 is 617 and 618 is 618 |  | C.S. 619, 620 where 1 is 619 and 620 is 620 |  | C.S. 621, 622 where 1 is 621 and 622 is 622 |  | C.S. 623, 624 where 1 is 623 and 624 is 624 |  | C.S. 625, 626 where 1 is 625 and 626 is 626 |  | C.S. 627, 628 where 1 is 627 and 628 is 628 |  | C.S. 629, 630 where 1 is 629 and 630 is 630 |  | C.S. 631, 632 where 1 is 631 and 632 is 632 |  | C.S. 633, 634 where 1 is 633 and 634 is 634 |  | C.S. 635, 636 where 1 is 635 and 636 is 636 |  | C.S. 637, 638 where 1 is 637 and 638 is 638 |  | C.S. 639, 640 where 1 is 639 and 640 is 640 |  | C.S. 641, 642 where 1 is 641 and 642 is 642 |  | C.S. 643, 644 where 1 is 643 and 644 is 644 |  | C.S. 645, 646 where 1 is 645 and 646 is 646 |  | C.S. 647, 648 where 1 is 647 and 648 is 648 |  | C.S. 649, 650 where 1 is 649 and 650 is 650 |  | C.S. 651, 652 where 1 is 651 and 652 is 652 |  | C.S. 653, 654 where 1 is 653 and 654 is 654 |  | C.S. 655, 656 where 1 is 655 and 656 is 656 |  | C.S. 657, 658 where 1 is 657 and 658 is 658 |  | C.S. 659, 660 where 1 is 659 and 660 is 660 |  | C.S. 661, 662 where 1 is 661 and 662 is 662 |  | C.S. 663, 664 where 1 is 663 and 664 is 664 |  | C.S. 665, 666 where 1 is 665 and 666 is 666 |  | C.S. 667, 668 where 1 is 667 and 668 is 668 |  | C.S. 669, 670 where 1 is 669 and 670 is 670 |  | C.S. 671, 672 where 1 is 671 and 672 is 672 |  | C.S. 673, 674 where 1 is 673 and 674 is 674 |  | C.S. 675, 676 where 1 is 675 and 676 is 676 |  | C.S. 677, 678 where 1 |  |
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TABLE 2

| O. O. S.<br>PARAMETER | PERFORM<br>POSITIONS  | PARAMETERS TO BE REQUALIFIED     |
|-----------------------|-----------------------|----------------------------------|
| NBDY                  | 1                     | NBDY                             |
| NBDZ                  | 2                     | NBDZ                             |
| NBDX                  | 3                     | NBDX                             |
| ADSRAY                | 1 and 4               | ADSRAY, NBDY                     |
| ADGRAZ                | 2 and 9               | ADGRAZ, NBDZ                     |
| ADSRAX                | 3 and 7               | ADSRAX, NBDX                     |
| ADLAY                 | 1 thru 3,<br>7 and 10 | NBDY, NBDX, ADLAX, ADSRAX, ADLAY |
| ADLAZ                 | 2 thru 4              | NBDZ, NBDX, ADLAZ                |
| ADLAX                 | 1 thru 3              | NBDX, ADLAX, NBDY                |
| X PIPA Bias or S. F.  | 1 thru 2              | X PIPA BIAS, X PIPA S. F.        |
| Y PIPA Bias or S. F.  | 5 and 6               | Y PIPA BIAS<br>Y PIPA S. F.      |
| Z PIPA Bias or S. F.  | 3 and 4               | Z PIPA BIAS,<br>Z PIPA S. F.     |

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- 5.5 Retest subsequent to replacement of a malfunctioned assembly with that of a flight certified assembly shall be at the discretion of NASA Engineering. Table II can be used as a guide to determine general retest requirements. In all retest procedures, the test sequence of Figure 1 shall be adhered to.
- 5.5.1 The resistance between the CMC case and structural ground shall be less than .05 ohms.
- 5.6 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps related directly to the G&N System components. If any questions arise concerning the test equipment, the Test Conductor should refer to the pertinent operational manuals.
- 5.7 The following requirements shall be completed before any of the tests in this specification are attempted.
- 5.7.1 The G&N System shall be Government Furnished Property.
- 5.7.2 The installation of the G&N System into the spacecraft shall have been completed as specified in Mechanical Installation Specification for Apollo Guidance Equipment Block II MA0306-0107.
- 5.7.2.1 Interfacing systems (SCS, C & IS, EPS, ECS) shall have been verified to conform to loading and operational requirements as specified by the appropriate ICD.
- 5.7.3 All ACE equipment shall have been qualified in accordance with the respective quality assurance specifications prior to use with the G&N System.

TABLE II. RETEST MATRIX

| Paragraph Number | Test Title                                 | IMU | NAV BASE | OPTICS | CMC | P&A | LEB DSKY | MDC DSKY | SEQ. COND. | CDU | G&N HARNESS | PIPA ELECT. | INDICATOR CONTROL PANEL |
|------------------|--------------------------------------------|-----|----------|--------|-----|-----|----------|----------|------------|-----|-------------|-------------|-------------------------|
| 6.5.1            | AGC Ground Check                           |     |          |        |     |     |          |          |            |     |             |             |                         |
| 6.2.1            | Application of Standby Power to G&N System | X   | X        |        | X   | X   | X        | X        | X          | X   | X           | X           |                         |
| 6.2.5            | General Turn Off and Turn On Procedure     |     |          | *      |     |     |          |          |            |     |             |             |                         |
| 6.2.3            | Operate Power on Test                      | X   | X        |        | X   | X   | X        | X        | X          | X   | X           | X           |                         |
| 6.2.2            | CMC Operational Test                       |     |          |        | X   | X   | X        | X        | X          | X   | X           | X           |                         |
| 6.2.9            | G&N Panel Brightness and Lamp Test         | X   | X        | X      |     |     | X        | X        |            |     | X           |             | X                       |
| 6.2.6            | G&N Operational Test                       | X   | X        | X      | X   | X   |          |          |            | X   | X           | X           | X                       |
| 6.2.10           | Zero Optics Test                           |     | X        | X      | X   | X   |          |          | X          | X   | X           |             | X                       |
| 6.2.13           | Optics Slow Rate Test                      |     | X        | X      | X   | X   |          |          | X          | X   | X           |             | X                       |
| 6.2.11           | Optics Coordinate Transformation Control   |     | X        | X      |     | X   |          |          |            |     | X           |             | X                       |
| 6.2.12           | Optics Function Test - VAB and PAD         |     | X        | X      | X   | X   |          |          |            | X   | X           |             | X                       |
| 6.2.9            | Semi-Automatic Mode Control Test           | X   | X        | X      | X   | X   |          |          | X          | X   | X           |             |                         |
| 6.2.14           | Slab Loop Step Response Test               | X   | X        | X      |     | X   |          |          | X          | X   |             |             |                         |
| 6.2.15           | IRIG Scale Factor Test                     | X   | X        |        |     | X   |          |          |            |     |             |             |                         |
| 6.2.16           | IMU Performance Test                       | X   | X        | X      |     | X   |          |          |            |     |             | X           |                         |
| 6.2.17           | Flare Alignment Test                       | X   | X        | X      |     | X   |          |          |            | X   | X           |             |                         |
| 6.2.19           | Voltage Margin Test                        | X   | X        | X      | X   | X   |          |          |            | X   | X           |             |                         |
| 6.2.7            | Gimbal Friction Test                       | X   | X        |        |     |     |          |          |            |     |             |             |                         |
| 6.2.18           | Gyrocompassing Test                        | X   | X        | X      |     |     |          |          | X          |     | X           |             |                         |
| 6.2.4            | G&N Power Supplies Test                    | X   | X        | X      | X   | X   |          |          | X          | X   | X           | X           |                         |
| 6.2.20           | S/C Control & Display Test                 |     |          |        |     |     |          |          |            |     |             |             |                         |

\* To be used as necessary to turn system on and off.



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5.12.1 The APOLLO G&N System shall interface with accepted ECS and EPS distribution systems for power and environment control purposes and with the SCS or SCS substitute system for signal interface in accordance with the applicable ICD's.

5.13 General System Operating characteristics.

5.13.1 The program does not automatically display computer error codes when a PROG alarm occurs. If error code is desired enter the following on K-148 and then observe the DSKY display.

VERB 05 NOUN 09 ENTR

R1 = FAILREG  
R2 = FAILREG +1  
R3 = FAILREG +2

5.13.2 The DSKY "NO ATT" lamp illuminates any time the system is in the Coarse Align Mode, IMU Cage, or during turn on.

5.13.3 Tracker Fail lamp may light after optics power turn on. Press the Error Reset to extinguish.

5.13.4 The CMC warning light may come on for approximately 20 seconds when +28 VDC CMC Operate Power is applied; if the MASTER ALARM light illuminates, push to reset.

5.13.5 When coming out of AGC STBY, if the Standby lamp does not extinguish when the PRO pushbutton is pressed, repeatedly press the PRO pushbutton until the Standby lamp does extinguish. Record the number of times it was necessary to press the STBY pushbutton. No more than three depressions of the PRO pushbutton shall be required to turn the STBY lamp off.

6.0 DETAIL REQUIREMENTS

6.1 Initial Test Conditions

6.1.1 The following precautions shall be observed to preclude loss of continuity in inertial component performance history of the IMU. Deviation may necessitate recalibration of the inertial components.

6.1.1.1 The IMU shall be supplied with heater power on a continuous basis. When S/C Ground Power Supply, Model No. C14-418 is not providing heater power, then the heater power shall be supplied through the Portable Temperature Controller (PTC) Model No. 823-011. The temperature of the IRIG's shall be maintained between 120° and 150°F. The temperature of the PIPA's shall be maintained between 115° and 145°F.

6.1.1.2 The Standby Mode is identified by the circuit breakers IMU HTR MN A, IMU HTR MN B, COMPUTER MN A and MN B in the ON position and the G&N Power-IMU switch on LEB Lighting Control Panel in the OFF position. The Operate Mode is identified by the circuit breaker IMU HTR MN A, MN B, COMPUTER MN A and MN B in the ON position and the G&N Power-IMU switch on the LEB Lighting Control Panel in the ON position. The G&N System shall be operating in the Standby Mode with CMC power ON for a minimum of two hours prior to advancing to the IMU Operate Mode. In the event Standby or CMC power is interrupted, an equivalent time period, but not less than 15 minutes, shall be allowed when power is restored before advancing to the Operate Mode, except that when the interval of interruption exceeds two hours, a two-hour warmup period shall be mandatory (exceptions to the 2-hour warmup are noted in 6.2.5.2).

6.1.1.3 The Inertial Measurement Unit shall not be without heater power for more than 15 minutes.

6.1.1.4 During the turn on of the G&N power, COMPUTER MN A and MN B and IMU HTR MN A and IMU HTR MN B circuit breakers must be turned on before the IMU MN A and IMU MN B circuit breakers on the Right Hand Circuit Breaker Panel of the CM. During the turn off of the G&N power the IMU MN A and IMU MN B circuit breakers must be turned off before the IMU HTR MN A and IMU HTR MN B circuit breakers on the Right Hand Circuit Breaker Panel of the CM. In no case shall COMPUTER MN A and MN B circuit breaker be turned off before IMU MN A and MN B circuit breakers.

6.1.1.5 A warmup period of 1 hour with OPERATE power applied shall be required prior to performing any test in which gyro and accelerometer parameters are measured, and 15 minutes warmup prior to any test in which precision amplitude and frequency power supply checks are made.

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- 6.1.1.6 The following Command Module switches shall be in the position shown unless specifically directed otherwise in a procedural function.
- a. UP TLM switches on the LEB G&N Control Panel and MDC Panel 2 shall be set to ACCEPT.
  - b. LAUNCH VEHICLE - GUIDANCE switch on MDC Panel 2 shall be set to IU.
  - c. The SC CONT switch on MDC Panel 1 shall be set to CMC.
  - d. The CMC MODE switch on MDC Panel 1 shall be set to AUTO.
  - e. The V CG switch on MDC Panel 1 shall be set to CSM.
  - f. The LIGHTS-INTEGRAL control on the LEB Lighting Control Panel and the Left Hand Circuit Breaker panel shall be set to the minimum brightness - OFF position.
- 6.1.2 The following optical reference alignment requirements shall be demonstrated - MSO only.
- 6.1.2.1 G&N Installation Qualification Fixture.
- 6.1.2.1.1 The SXT Optical Reference NO. 1 (Azimuth Autoset) LOS shall be located approximately 40 degrees (CW when viewed from above) from the SCZ axis measured in a horizontal plane. At this position, the Optical Reference shall be capable of being viewed through the SXT ST LOS.
- 6.1.2.1.2 The SXT Optical Reference LOS position with respect to the horizontal plane shall be known to within 5 arc-seconds. The azimuth bearing of the Optical Reference LOS shall be known to within  $\pm 30$  minutes of arc.
- 6.1.2.1.3 The SXT Optical Reference NO. 2 LOS shall be located approximately 80 degrees from the SXT Optical Reference No. 1 (40 degrees from S/C Z axis) measured in a horizontal plane. At this position, the Optical Reference shall be capable of being viewed through the SXT STAR LOS.
- 6.1.2.1.3.1 The SXT optical reference LOS position with respect to the horizontal plane shall be known to within 5 arc-seconds. The azimuth bearing of the Optical Reference LOS shall be known to within  $\pm 30$  minutes of arc.
- 6.1.2.1.4 SXT Optical Reference No. 3 shall be capable of being viewed through the SXT LLOS and the STAR LOS simultaneously at the Zero Optics position.
- 6.1.2.1.4.1 SXT Optical Reference No. 3 shall have the capability to measure the non-parallelism of the LLOS and STAR LOS to a resolution of 2-arc-seconds.

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- 6.1.3 Deleted.
- 6.1.4 Emergency Shutdown Procedure
- CAUTION:** In the event of a malfunction occurrence which could damage the G&N System before the normal shutdown procedure 6.2.5 could be performed, the following sequence should be utilized in the spacecraft.
- 6.1.4.1 On the LEB Lighting Control Panel set the G/N POWER-IMU and G/N POWER - OPTICS switches to OFF.
- 6.1.4.2 On the Right Hand Circuit Breaker Panel set the following switches and circuit breakers to OFF (breakers pulled out).
- GUIDANCE/NAVIGATION COMPUTER MN A and MN B
  - GUIDANCE/NAVIGATION IMU HTR MN A and MN B
  - G/N POWER switch to OFF
  - GUIDANCE/NAVIGATION IMU MN A and MN B
  - GUIDANCE/NAVIGATION OPTICS MN A and MN B
  - GUIDANCE/NAVIGATION POWER AC 1 and AC 2
- 6.1.4.3 Verify that the PTC is providing heater power to the G&N System.
- 6.2 Test Procedures
- 6.2.1 Application of Standby Power to G&N System
- 6.2.1.1 All power and control switches on the G&N Indicator Control Panel shall be placed in the OFF or neutral position.
- 6.2.1.2 The Portable Temperature Controller (PTC), shall be supplying inertial component heater power to the G&N System through the PSA, Connector No. 45J2.
- 6.2.1.3 Computer Power On
- 6.2.1.3.1 Set the POWER-AC1 and AC2 breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in), and position G/N POWER switch to AC1.
- 6.2.1.3.2 Set the G&N COMPUTER MN A and MN B Breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in).

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- 6.2.1.3.3 Set the computer numerical display lights to the minimum acceptable brightness by rotating the Brightness Controls on the MDC and LEB Lighting Control Panels.
- 6.2.1.3.4 The +28 VDC CMC OPERATE voltage (CG 1520) shall be  $\pm 28.8 \pm 3$  VDC. Verify CRT indication. On DSKY verify TEMP light is ON. On the G&N Indicator Control Panel verify PGNS light is ON.
- 6.2.1.3.5 The voltage output of the +4 VDC CMC supply shall be  $\pm 4.00 \pm 0.20$  VDC, (CG1030). The value on the CRT shall be recorded.
- 6.2.1.3.6 The voltage output of the +14 VDC CMC supply shall be  $\pm 14.0 \pm 0.4$  VDC, (CG1020). The value on the CRT shall be recorded.
- 6.2.1.3.7 Using DSKY, enter VERB 36, ENTR, then press RESET. Verify that R1, R2, R3, VERB, NOUN, and PROG are blank.
- 6.2.1.3.8 IMU HTR Heater Power On
- 6.2.1.3.8.1 Enter the IMU Standby Mode of operation by engaging the IMU HTR MN A and MN B breakers on the Right Hand Circuit Breaker Panel (breakers pushed in).
- NOTE: Restart Lamp may illuminate, if it does, disregard and press RESET on the DSKY.
- 6.2.1.3.8.2 Verify that the IMU +28 VDC STANDBY discrete lamp on Event Module is illuminated (CG 1513). On DSKY verify TEMP light is extinguished. On the G&N Indicator Control Panel verify PGNS light is extinguished.
- 6.2.1.3.8.3 Record the value of the following signals displayed on the CRT.
- | Signal                                           | Requirement         |
|--------------------------------------------------|---------------------|
| a. CG 1331 28V 3200 CPS<br>POWER SUPPLY FEEDBACK | 28.6 $\pm$ 0.6 VRMS |
| b. CG 1510 +28 VDC<br>STANDBY POWER              | 28.8 $\pm$ 3 VDC    |
- 6.2.1.3.8.4 The PIPA TEMP on the CRT shall be monitored at 15 min., 1 hr. and 2 hrs. from execution of 6.2.1.4.1 to insure that the PIPA Temperature Control Loop circuitry is operating to maintain a temperature of  $130.5 \pm 1.5^\circ\text{F}$  (CG2300).
- 6.2.1.3.8.5 At the termination of the 2-hour period, record the PIPA temperature (CG2300) on the CRT. On the event recorder verify that the IMU HEATER current discrete (CG2302) is ON and that the IMU BLOWER current discrete (CG2303) is OFF over the last two hour period (occasionally discretely may cycle).

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6.2.1.3.8.6 With the eyepiece in the Eyepiece Storage Unit, check the eyepiece surface temperature at the quick disconnect flange using an L&N #8693 Temperature Potentiometer, or a similar type thermocouple probe meter. Record both the ESU ambient and eyepiece surface temperatures. Verify that the eyepiece surface temperature is between 5 and 30 degrees F. above the ambient temperature.

6.2.1.3.9 Deleted.

6.2.1.3.10 Initiate CMC self-check by entering the following sequence into the K-start:

- a. VERB 21 NOUN 27, ENTER
- b. 77777, ENTER
- c. VERB 16 NOUN 01, ENTER
- d. 1366, ENTER

6.2.1.3.10.1 Monitor until R2 (SCOUNT +1) increments twice. If an error is detected the PROGRAM ALARM lamp on the DSKY's shall light.

6.2.1.3.10.2 Terminate the monitor routine by entering the following into the DSKY.  
VERB 34, ENTER

6.2.1.3.10.3 Enter the following into the K-start:

- a. VERB 21
- b. NOUN 27, press ENTER pushbutton
- c. 00000, press ENTER pushbutton

6.2.2 CMC Operational Test

NOTE: Verify that IMU STANDBY power (including CMC operate power) is applied, IMU OPERATE Power is not applied. (G&N IMU HTR MN A and MN B breakers engaged, Computer MN A and MN B breakers engaged, IMU MN A and MN B breakers disengaged, G/N Power-IMU switch on LEB Lighting Control Panel in OFF Position).

6.2.2.1 Using the LEB CMC DSKY, enter the following sequence of data into the CMC to initiate the DSKY check. Press the ENTER pushbutton after each entry denoted by E).

VERB 34, E Press RESET

VERB 21 NOUN 27, E

77766, E

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6.2.2.2 All the electroluminescent elements (PROG, VERB, NOUN, and Row 1, Row 2, Row 3) shall display the decimal number (9), including the 9's, each of the following shall be displayed for approximately 5 seconds.

- a. 9's
- b. 8's
- c. 7's
- d. 6's
- e. 5's
- f. 4's
- g. 3's
- h. 2's
- i. 1's
- j. 0's
- k. Minus signs in Rows 1, 2, 3 (On concurrently for 5 sec)
- l. VERB-NOUN flashing (On concurrently for 5 sec)
- m. COMP ACTY (On concurrently for 5 sec)
- n. Plus signs in Rows 1, 2, 3 (On concurrently for 5 sec)
- p. VERB-NOUN flashing (On concurrently for 5 sec)
- q. COMP ACTY (On concurrently for 5 sec)
- r. COMP ACTY - On for 5 seconds, then DSKY blanks.

6.2.2.3 CAUTION and STATUS Displays

6.2.2.3.1 Enter VERB 35, ENTER, into LEB CMC DSKY.

6.2.2.3.2 The following MDC and LEB CMC DSKY displays shall illuminate for approximately 5 seconds.

- a. UPLINK ACTY
- b. NO ATT
- c. STBY
- d. KEY REL Flashing
- e. TEMP
- f. GIMBAL LOCK
- g. PROG
- h. RESTART
- i. TRACKER

6.2.2.3.2(Cont) j. OPR ERROR Flashing

k. COMPACTY

l. PROGRAM 88

m. VERB 88 NOUN 88 flashing

n. +88888 in R1, R2 and R3

o. PGNCB. CMC, ISS WARNING lights (CMC shall remain illuminated for 15-5 seconds).

After indications a. through m. go out, +88888 shall remain in R1, R2, R3.

6.2.2.4 DSKY Pushbutton Check

6.2.2.4.1 Enter the following sequence into the LEB CMC DSKY. Press the ENTER pushbutton after each entry (denoted by E).

- a. VERB 25 NOUN 01, E
- b. 02100, E
- c. +00123, E
- d. -00456, E
- e. -00789, E

6.2.2.4.2 The LEB CMC DSKY shall indicate +00123 in R1, -00456 in R2, and -00789 in R3.

6.2.2.4.3 Enter VERB 05, NOUN 01 into the LEB CMC DSKY. Press the ENTER pushbutton.

6.2.2.4.4 Enter 02100 into LEB CMC DSKY. Press the ENTER pushbutton. The LEB CMC DSKY shall indicate 00024 in R1, 77664 in R2, and 77576 in R3. Verify.

6.2.2.4.5 Enter the following sequence into the LEB CMC DSKY.

- a. VERB 21 NOUN 01, ENTER
- b. 02100, ENTER
- c. +00123, DO NOT press ENTER

6.2.2.4.5.1 Press the CLEAR pushbutton. R1 shall clear.

6.2.2.4.6 Enter VERB 06 NOUN 70 into the LEB CMC DSKY. Press the ENTER pushbutton. The operator Error Light shall light.

6.2.2.4.6.1 Press the RESET pushbutton. The Operator Error light shall extinguish.



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- 6.2.2.4.7 Enter the following sequence into the LEB CMC DSKY. Press the ENTER pushbutton as indicated. The Key Release Light shall light.
- a. VERB 16, NOUN 20, ENTER
  - b. VERB
- 6.2.2.4.7.1 Press the KEY RELEASE pushbutton. The Key Release light shall extinguish.
- 6.2.2.4.7.2 Enter VERB 36, into the LEB CMC DSKY. Press the ENTER pushbutton.
- NOTE: 6.2.2.4.8 does not apply to STV-1
- 6.2.2.4.8 Press the PRO pushbutton and verify the CH 32 on the CRT displays 5XXXX. Release the PRO pushbutton and verify that CH 32 on the CRT displays 7XXXX.
- 6.2.2.4.9 Repeat 6.2.2.4.1. through 6.2.2.4.8 using the MDC CMC DSKY.
- 6.2.2.5 Uplink and Downlink Checks.
- 6.2.2.5.1 Enter VERB 36 into K148. Press the ENTER pushbutton, then press ERROR RESET pushbutton.
- a. VERB 25 NOUN 01 ENTER
  - b. 02100, ENTER
  - c. 00000, ENTER
  - d. 77777, ENTER
  - e. 07254, ENTER
  - f. VERB 05 NOUN 01, ENTER
  - g. 02100, ENTER
- 6.2.2.5.3 CMC Registers R1, R2, and R3 display on the CRT shall indicate 00000, 77777, and 07254, respectively/
- 6.2.2.5.4 Set/Verify that the UP TLM switch on the Main Display Panel is set to ACCEPT and that the UP TLM switch on the G&N Indicator Control Panel is set to BLOCK.
- 6.2.2.5.5 Execute the Block Uplink Override R-START to enable data to be sent via K-START. On K-148 insert VERB. Verify that the VERB indications on the DSKY and CRT does not change.
- 6.2.2.5.6 Set the UP TLM switch on the G&N Indicator Control Panel to ACCEPT. Verify that the BLOCK UPLINK discrete is OFF.
- 6.2.2.5.7 On K-148 insert VERB 01. Verify that the VERB indication on the DSKY and CRT is 01.

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- 6.2.2.5.8 Set the UP TLM switch on the MAIN DISPLAY Panel to BLOCK. Verify that the BLOCK UPLINK discrete is ON.
- 6.2.2.5.9 On K-148 insert VERB. Verify VERB indication on the DISKY and CRT does not change.
- 6.2.2.5.10 Set the UP TLM switch on the MAIN DISPLAY Panel to ACCEPT. Verify that the BLOCK UPLINK discrete is OFF. Remove the Block Uplink Override R-START.
- 6.2.2.5.11 On K-148 insert VERB 36. Press the ENTER pushbutton.
- 6.2.2.6 Deleted
- 6.2.2.7 Parity Fail Test
- 6.2.2.7.1 Enter the following into the K-148. Press the ENTER pushbutton after each entry.
  - a. Deleted.
  - b. Deleted.
  - c. VERB 24 NOUN 02, ENTER
  - d. 02100 ENTER
  - e. 33777, ENTER
  - f. 04544, ENTER
  - g. VERB 25 NOUN 26, ENTER
  - h. 04000, ENTER
  - j. 01500 ENTER
  - k. 00004 ENTER
  - m. VERB 30, ENTER

The RESTART lamps on the MDC & LEB DISKY's shall illuminate. The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.
- 6.2.2.7.2 Press the ERROR RESET pushbutton on the K-Start. The RESTART & PGNS caution lamps shall extinguish.
- 6.2.2.7.3 Enter VERB 36, into the K-148. Press the ENTER pushbutton.

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6.2.2.8 Rupt Lock Test

6.2.2.8.1 Enter the following sequence into the K-148. Press the ENTER pushbutton after each entry.

a. VERB 24 NOUN 01, ENTER

b. 02100, ENTER

c. 30001, ENTER

d. 01500, ENTER

e. VERB 25 NOUN 26, ENTER

f. 00001, ENTER

g. 01500, ENTER

h. 00004, ENTER

i. VERB 31, ENTER

The RESTART and PROG lamps on the MDC and LEB DSKY's shall illuminate. The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.

6.2.2.8.2 Press the ERROR RESET pushbutton on the K-148. The RESTART & PGNS caution lamps shall extinguish.

6.2.2.8.3 Enter VERB 36 into the K-148. Press the ENTER pushbutton.

6.2.2.9 TC Trap Test

6.2.2.9.1 Enter the following sequence into the K-148. Press the ENTER pushbutton after each entry.

a. VERB 21 NOUN 02, ENTER

b. 02100, ENTER

c. 01500, ENTER

d. VERB 25 NOUN 26, ENTER

e. 04000, ENTER

f. 01500, ENTER

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6.2.2.9.1(Cont) g. 00004 ENTER

h. VERB 30, ENTER

The RESTART and PROG lamps on the MDC & LEB DSKY's shall illuminate.  
The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.

6.2.2.9.2 Press the ERROR RESET pushbutton on the K-148. The RESTART & PGNS  
caution lamps shall extinguish.

6.2.2.9.3 Enter VERB 36 into the K-148. Press the ENTER pushbutton.

6.2.2.10 Nightwatchman Test

6.2.2.10.1 Enter the following sequence into the K-148. Press ENTER pushbutton after  
each entry.

a. VERB 24 NOUN 01, ENTER

b. 02100, ENTER

c. 30001, ENTER

d. 01500, ENTER

e. VERB 25 NOUN 26, ENTER

f. 04000, ENTER

g. 01500, ENTER

h. 00004, ENTER

i. VERB 30, ENTER

The RESTART and PROG lamps on the MDC & LEB DSKY's shall illuminate.  
The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.

6.2.2.10.2 Press the ERROR RESET pushbutton on the K-148. The RESTART & PGNS  
caution lamps shall extinguish.

6.2.2.10.3 Enter VERB 36 into the K-148. Press the ENTER pushbutton.

6.2.2.11 Bank Sum Check

6.2.2.11.1 From a program listing for the installed CMC ropes, obtain a list of bank  
CKSM bugger words.

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- 6.2.2.11.2 Enter VERB 91, ENTER into K148.
- 6.2.2.11.3 Record the following:
- R1 - Bank Sum
  - R2 - Bank Number
  - R3 - Bank CKSM bugger word
- R1 shall be the same as R2.  
R3 shall equal the CKSM bugger word for the indicated bank.  
Enter VERB 33, ENTER
- 6.2.2.11.4 Repeat 6.2.2.11.3 until all banks have been checked. Terminate the Bank Sum Test by entering VERB 34, ENTER into K148.
- 6.2.2.12 CMC Clock Frequency Test.
- 6.2.2.12.1 Insure that CMC operate power has been applied for a minimum of 10 minutes before performing this test.
- 6.2.2.12.2 Verify that the counter is connected to the 3.2 kc signal on the hardline.
- 6.2.2.12.3 Insure that the counter has been warming up for a minimum of 30 minutes.
- 6.2.2.12.4 On the counter,
- Set the FUNCTION switch to: MAN START
  - Set the TIME BASE switch to: 1 usec TIME UNIT/COUNT
  - Set the SENSITIVITY control to: CHECK
- 6.2.2.12.5 Verify proper counter operation.
- 6.2.2.12.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.
- 6.2.2.12.7 Plug in the Preset unit and set:
- MODE switch to PRESET
  - N switches to 96000.
- 6.2.2.12.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.
- 6.2.2.12.9 Start counting by depressing RESET switch on counter.
- 6.2.2.12.10 After approximately 30 seconds, read and record counter display.

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- 6.2.2.12.11 Repeat steps 6.2.2.12.9 and 6.2.2.12.10 nine times.
- 6.2.2.12.12 The average of the 10 previous readings shall be  $30.000000 \pm 0.000050$  seconds.
- 6.2.2.12.13 Insure that the system is not in IMU Operate.
- 6.2.2.12.14 Perform the following DSKY operations:
- |         |           |
|---------|-----------|
| VERB 37 | ENTR      |
| 06      | ENTR/ENTR |
- Press and hold the PRO pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is lighted.
- 6.2.2.12.15 Repeat steps 6.2.2.12.9 through 6.2.2.12.12.
- 6.2.2.12.16 Press and hold the PRO pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is not lighted.
- 6.2.2.12.17 Perform the following DSKY operations:
- |         |      |
|---------|------|
| VERB 37 | ENTR |
| 05      | ENTR |
- 6.2.2.13 Minimum Impulse Controller Input Test.
- 6.2.2.13.1 Enter the following into the DSKY.
- |            |          |       |
|------------|----------|-------|
| a. VERB 11 | NOUN 10, | ENTER |
| b. 00032   | ENTER    |       |
- 6.2.2.13.2 Set the Minimum Impulse Controller on the Indicator Control Panel to the following position and observe R1 of the DSKY for the proper indications.
- | MIC Position        | R1 DSKY Indication |
|---------------------|--------------------|
| a. Up               | 77775              |
| b. Down             | 77776              |
| c. Left             | 77737              |
| d. Right            | 77757              |
| e. Clockwise        | 77773              |
| f. Counterclockwise | 77767              |
| g. Neutral          | 77777              |
- 6.2.2.13.3 Enter VERB 34, ENTER into the DSKY.

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- 6.2.2.14 Mark and Mark Reject pushbutton test.
- 6.2.2.14.1 On the G&N Indicator Control Panel press and hold MARK pushbutton.
- 6.2.2.14.2 Observe PROG alarm lamp is lighted.
- 6.2.2.14.3 Enter the following in K-148:
- |         |         |      |
|---------|---------|------|
| VERB 11 | NOUN 10 | ENTR |
| 00016   |         | ENTR |
- 6.2.2.14.4 Observe that DSKY row 1 displays 00040.
- 6.2.2.14.5 Release MARK pushbutton.
- 6.2.2.14.6 Observe that DSKY Row 1 displays 00000. Press ERR RSET pushbutton.
- 6.2.2.14.7 Press and hold the REJECT pushbutton on the G&N Indicator Control Panel.
- 6.2.2.14.8 Observe PROG alarm lamp is lighted.
- 6.2.2.14.9 Observe that DSKY Row 1 displays 00100.
- 6.2.2.14.10 Release the REJECT pushbutton.
- 6.2.2.14.11 Observe that DSKY Row 1 displays 00000. Press ERR RSET pushbutton.
- 6.2.2.14.12 On the DSKY perform the following operation:
- |         |      |
|---------|------|
| VERB 36 | ENTR |
|---------|------|
- 6.2.3 Operate Power On Test
- 6.2.3.1 IMU Operate Power ON
- CAUTION: The sequences specified in this test must be adhered to. Deviations may necessitate recalibration of the inertial components.
- NOTE: Disregard the GIMBAL LOCK indicator until the completion of Step 6.2.3.1.6.
- 6.2.3.1.1 The following Command Module switches and circuit breakers shall be in the following state:
- Right Hand Circuit Breaker Panel

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- 6.2.3.1.1(Cont.) a. GUIDANCE/NAVIGATION COMPUTER MN A and MN B breakers on (pushed in)
- b. GUIDANCE/NAVIGATION IMU HTR MN A and MN B breakers on (pushed in)
- c. GUIDANCE/NAVIGATION IMU MN A and MN B breakers off (pulled out)
- d. GUIDANCE/NAVIGATION OPTICS MN A and MN B breakers off (pulled out) LEB Lighting Control Panel
- e. G/N Power - IMU set to OFF
- f. G/N Power - Optics set to OFF

6.2.3.1.2 Switches and selectors on the G&N Indicator control panel shall be set as follows:

- a. OPTICS ZERO to ZERO
- b. OPTICS MODE to MANUAL
- c. OPTICS COUPLING to DIRECT
- d. OPTICS SPEED to MED
- e. OPTICS TEL TRUN to SLAVE to EXT
- f. RETICLE BRIGHTNESS to minimum brightness position

6.2.3.1.3 Adjust the Command Module MDC and LEB Lighting Controls to minimum intensity for proper readout of G&N Displays.

6.2.3.1.4 Set up the ACE analog recorders to monitor the following measurements (set chart speed to 5 mm/sec):

- a. CG 2117 IGA Servo Error In Phase
- b. CG 2177 OGA Servo Error In Phase
- c. CG 2147 MGA Servo Error In Phase
- d. CG 2112 IG IX Resolver Output Sin
- e. CG 2172 OG IX Resolver Output Sin
- f. CG 2142 MG IX Resolver Output Sin
- g. CG 1040 +120 VDC P1PA Supply DC Level

CAUTION: Before proceeding, insure that the G&N System has been operating in the STANDBY MODE (power configuration as defined in 6.2.3.1) for a minimum period of 2 hours. Exceptions to this requirement are noted in 6.2.5.2.9.

CAUTION NOTE: If the requirements of 6.2.3.1.6 are not met, remove IMU operate power immediately by placing the G/N POWER-IMU switch on the LEB Lighting Control Panel to OFF.



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- 6.2.3.1.5 Perform the following sequence:
- Turn on the IMU MN A and MN B circuit breakers on the Right Hand Circuit Breaker Panel (breakers pushed in).
  - Start Analog Recorders.
  - Place G/N Power - IMU switch on the LEB Lighting Control Panel to IMU (switch toggle up).
- 6.2.3.1.6 Immediately begin monitoring the following measurements.
- The IMU Operate Power is  $\pm 28.8 \pm 3$  VDC (CG 1500). Verify on CRT.
  - On the recorders, verify that oscillations are not sustained and that a null is achieved within 10 seconds of power application in 6.2.3.1.5 on the following measurements:  
  
CG 2112, IG IX Receiver Output Sin  
CG 2142, MG IX Receiver Output Sin  
CG 2172, OG IX Receiver Output Sin
  - Deleted.
  - On the CRT, verify the absence of the +120 VDC PIPA supply (CG 1040) for a period of 90±10 seconds following power application in 6.2.3.1.5. Verify PIPA fail discrete is present during this period. After approximately 100 seconds, the voltage shall read  $\pm 120 \pm 6$  Vdc.
  - Stop the analog recorders.
- 6.2.3.1.7 Insure that the following alarm lamps are not lighted on G&N LEB Display Panel.
- CMC Warning
  - ISS Warning
  - PGNS Caution
- 6.2.3.1.8 Verify that the PROGRAM ALARM lamp on the DSKY's does not light.
- 6.2.3.1.9 The OG, IG, and MG CDU angles shall be 00000±00150. Verify on CRT.
- 6.2.3.1.10 Enter the following into K-148:
- VERB 41 NOUN 20, ENTER
  - +00000, ENTER
  - +00000, ENTER
  - +00000, ENTER

6.2.3.1.11 Verify that the following secondary power supply voltages are not flashing on the CRT display.

TABLE VI. SECONDARY POWER SUPPLY VOLTAGES

| Mess. No.   | Signal                     |
|-------------|----------------------------|
| 1. CG 1041  | +120 VDC PIPA SUPPLY       |
| 2. CG 1051  | +20 VDC PIPA SUPPLY        |
| 3. CG 1052  | -20 VDC PIPA SUPPLY        |
| 4. CG 1070  | +4 VDC CDU SUPPLY          |
| 5. CG 1100  | -28 VDC ELECTRONICS        |
| 6. CG 1021  | +14 VDC CMC SUPPLY         |
| 7. CG 1080  | +4 VDC CMC SUPPLY          |
| 8. CG 1201  | IMU 28V 800 CPS 1 pct 0 ph |
| 9. CG 1202  | IMU 28V 800 CPS 5 pct ph A |
| 10. CG 1203 | IMU 28V 800 CPS 5 pct ph B |
| 11. CG 1331 | 3.2KC 28V SUPPLY           |
| 12. CG 1110 | 2.5 VDC TM BIAS            |

6.2.3.1.12 The IMU Platform should not be moved during the Temperature Control Test. 15 minutes after the application of IMU OPERATE power record PIPA TEMP (CG 2300) displayed on the CRT.

6.2.3.1.14 1 hour after the application of IMU OPERATE power monitor and record PIPA TEMP (CG 2300) every 5 minutes for 1 hour. Verify that each reading does not deviate from the average of each signal by more than 0.1°F.

6.2.3.1.15 When 2 hours have elapsed since the application of IMU OPERATE power record PIPA TEMP. PIPA TEMP shall be 130.5±1.5°F. PIPA TEMP shall be within 0.5°F of that recorded in 6.2.3.1.12 and 6.2.1.3.8.4.

6.2.3.2 Optics Power ON

6.2.3.2.1 Optics power shall be applied by actuating the G&N OPTICS MN A and OPTICS MN B breakers on the Right Hand Circuit Breaker Panel (breakers pushed in), and placing G/N Power - OPTICS switch on the LEB Lighting Control Panel to ON.

6.2.3.2.2 OPTICS +28 VDC discrete shall be issued (CG 1533). Verify by observing that the OPTICS lamp on Event Module is illuminated. Verify that the +28 VDC OPTX OPERATE BUS (CG 1530) is +28.8±3 VDC. Record the indication on the CRT.

6.2.3.2.3 Verify the following secondary power supply voltages on the CRT are not flashing:

CG 1211 OPTX 28V 800 CPS 1 pct 0 ph  
CG 1212 OPTX 800 CPS 5 pct-90 ph

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- 6.2.3.2.3.1 Set/verify OPTICS MODE on the G&N Indicator Control Panel to MAN.
- 6.2.3.2.3.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Panel to ZERO.
- 6.2.3.3 IMU Cage Test
- 6.2.3.3.1 Enter the following into the DSKY:
- a. VERB 40 NOUN 20, ENTER (wait 3 seconds)
  - b. VERB 41 NOUN 20, ENTER
  - c. +00200, ENTER
  - d. +00200, ENTER
  - e. +00200, ENTER
- Observe that the NO ATT lamps on the DSKY's light and that CDUX, CDUY, CDUZ on the CRT indicate approximately +00200.
- 6.2.3.3.2 Set up the Analog Recorder to monitor the following signals:
- a. EG 1X Resolver Output Sine (CG 2112)
  - b. MG 1X Resolver Output Sine (CG 2142)
  - c. OG 1X Resolver Output Sine (CG 2172)
- Start the Analog Recorders.
- 6.2.3.3.3 On MDC panel 1, press and hold the IMU CAGE switch in the CAGE position. On the Analog Recorder, verify that the 1X Sine signals (CG 2112, CG 2142, and CG 2172) null out at 0.5V rms or less.
- 6.2.3.3.4 Release the IMU CAGE switch. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Sustained oscillations shall be cause for immediate removal of IMU OPERATE power.
- 6.2.3.3.5 On the CRT verify that CDUX, CDUY and CDUZ are all between +00150 and +35850.
- 6.2.3.3.6 Stop the Analog Recorders.
- 6.2.4 G&N System Power Supplies Test
- 6.2.4.1 Proceed with this test if 6.2.3, Operate Power On Test, has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding with this test. Insure that the IMU Operate Power has been on for at least 15 minutes before proceeding with this test.

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- 6.2.4.2 Enter the following sequence into the K-Start. Verb 41 NOUN 20, ENTER; +00000 ENTER; +00000 ENTER; +00000 ENTER.
- 6.2.4.3 Set/Verify the following circuit breakers and switches on the Right Hand Circuit Breakers Panel and LEB.
- COMPUTER MN A to ON (pushed in) and COMPUTER MN B to OFF (pulled out).
  - G/N - POWER to AC1
  - IMU HTR MN A to ON (pushed in) and IMU HTR MN B to OFF (pulled out).
  - IMU MN A to ON (pushed in) and IMU MN B to OFF (pulled out).
  - G/N POWER - IMU to IMU
  - OPTICS MN A to ON (pushed in) and OPTICS MN B to OFF (pulled out).
  - G/N POWER - OPTICS to OPTICS
- 6.2.4.4 Record the voltage indicated on the CRT for the following signals:
- The +28 VDC IMU OPERATE (Bus No. 1) output voltage shall be  $+28.8 \pm 3$  VDC (CG 1500).
  - The +28 VDC IMU STANDBY (Bus No. 2) output voltage shall be  $+28.8 \pm 3$  VDC (CG 1510).
  - The +28 VDC CMC OPERATE (Bus No. 3) output voltage shall be  $+28.8 \pm 3$  VDC (CG 1530).
  - The +28 VDC OPTX OPERATE (Bus No. 4) output voltage shall be  $+28.8 \pm 3$  VDC (CG 1530).
  - The CG 2221, IGA CDU Coarse Error measurement shall be  $0.0 \pm 0.68$  V rms.
  - The CG 2251 MGA CDU Coarse Error measurement shall be  $0.0 \pm 0.68$  V rms.
  - The CG 2281 OGA CDU Coarse Error measurement shall be  $0.0 \pm 0.68$  V rms.
- 6.2.4.5 Record the voltage indicated on the CRT for the following power supplies:
- The +120 VDC PIPA Power Supply output voltage shall be  $120 \pm 6$  VDC (CG 1040).
  - The +20 VDC PIPA Power Supply output voltage shall be  $20.0 \pm 1.2$  VDC (CG 1051).
  - The -20 VDC PIPA Power Supply output voltage shall be  $-20 \pm 2$  VDC (CG 1052).
  - The -28 VDC Electronics Power Supply Output voltage shall be  $-28.5 \pm 6.0$  VDC (CG 1100).

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6.2.4.6 The following values shall be measured with the guidance reference clock synchronizing input pulse. Record the voltage indicated on the CRT.

- a. IMU 28V, 800 CPS 1% 0 deg voltage shall be  $28.0 \pm 0.6$  VAC (CG 1201).
- b. IMU 28V, 800 CPS, 5% PHA - 90 deg. voltage shall be  $28.0 \pm 1.4$  VAC (CG 1202).
- c. IMU 28V, 800 CPS, 5% PHB 0 deg. voltage shall be  $28.0 \pm 2.1$  VAC (CG 1203).
- d. Optics 28V, 800 CPS 1% 0 deg voltage shall be  $28.0 \pm 0.8$  VAC (CG 1211).
- e. Optics 28V, 800 CPS 5% - 90 deg voltage shall be  $28.0 \pm 1.5$  VAC (CG 1212).
- f. PH Diff IMU 5% 0 deg. -90 deg. (CG 1207) phase difference shall be  $-90^\circ \pm 10^\circ$ .
- g. PH Diff Optics 1% IMU 1% (CG 1220) phase difference shall be  $0^\circ \pm 10^\circ$ .

6.2.4.7 Record the voltages indicated on the CRT for the following power supplies:

- a. The +14 VDC CMC Power Supply output voltage shall be  $+14.0 \pm 0.4$  VDC (CG 1020).
- b. The +4 VDC CMC Power Supply output voltage shall be  $+4.0 \pm 0.2$  VDC (CG 1030).
- c. The +4 VDC CDU Power Supply output voltage shall be  $+4.0 \pm 0.2$  VDC (CG 1070).
- d. The +2.50 VDC TM BIAS SUPPLY output voltage shall be  $+2.50 \pm 0.06$  VDC (CG 1110).

6.2.4.8 Record the CRT indications for the following measurements:

- a. The 28V, 3200 CPS Power Supply feedback output voltage shall be  $28.6 \pm 0.6$  V RMS (CG 1331).
- b. The phase difference between the 3.2 Kc supply and CMC sync shall be  $0^\circ \pm 10^\circ$  (CG 1336).
- c. The +14 VDC CMC Power Supply rms noise shall be less than 0.2 vrms (CG 1021).
- d. The +4 VDC CMC Power Supply rms noise shall be less than 0.2 vrms (CG 1031).

6.2.4.8.1 Enter the following into the K-145:

```

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+09000 ENTR
Wait 15 seconds.

```

6.2.4.9 Set/Verify the following circuit breakers and switches on the Right Hand Circuit Breaker Panel and LEB:

- a. G/N POWER-OPTICS to OFF
- b. OPTICS MN B to ON (pushed in) and OPTICS MN A to OFF (pulled out)
- c. G/N POWER - IMU to OFF
- d. IMU MN B to ON (pushed in) and IMU MN A to OFF (pulled out).
- e. IMU HTR MN A to OFF (pulled out)
- f. G/N - POWER to OFF
- g. COMPUTER MN B to ON (pushed in) and COMPUTER MN A to OFF (pulled out)

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- 6.2.4.10 Verify that the +28 VDC CMC OPERATE output voltage is  $\pm 28.8 \pm 3$  VDC (CG 1520).
- 6.2.4.11 Set the G/N - POWER switch on the LEB to AC2. Set the IMU HTR MN B to ON (pushed in). Verify that the +28 VDC IMU STANDBY output voltage is  $\pm 28.8 \pm 3$  VDC (CG 1500).
- 6.2.4.12 Wait until 15 minutes have elapsed since setting G/N POWER - IMU to OFF in 6.2.4.9. c then set the G/N POWER - IMU to IMU. Verify that the +28 VDC IMU OPERATE output voltage is  $\pm 28.8 \pm 3$  VDC (CG 1500).
- 6.2.4.13 Set the G/N POWER - OPTICS to OPTICS. Verify that the +28 VDC OPTX OPERATE output voltage is  $\pm 28.8 \pm 3$  VDC (CG 1530).
- 6.2.4.14 Repeat 6.2.4.5 through 6.2.4.8.
- 6.2.4.15 Set the following circuit breakers to the position indicated:
  - a. Set the COMPUTER MN A to ON (pushed in).
  - b. Set the IMU HTR MN A to ON (pushed in).
  - c. Set the IMU MN A to ON (pushed in).
  - d. Set the OPTICS MN A to ON (pushed in).
- 6.2.4.16 Miscellaneous Checks - The following miscellaneous signals are required to supply data for system evaluation in the event of failure, or for trend analysis of system performance. Record the values displayed on the CRT for the following signals.
  - a. CG 4300 CMC Temperature
  - b. CG 6020 PIPA Calibration Module Temperature
  - c. CG 6021 IMU 800 CP8 5% Temperature
- 6.2.4.17 Verify and record the following signals displayed on the CRT:
  - a. +120 VDC PIPA SUP NOISE RMS shall be less than 1.5 VRMS (CG 1042).
  - b. +20 VDC PIPA SUP NOISE RMS shall be less than 1.0 VRMS (CG 1053).
  - c. +4 VDC CDU SUP NOISE RMS shall be less than 0.1 VRMS (CG 1071).
  - d. +28V IMU OPERATE BUS NOISE RMS shall be less than 1.0 VRMS (CG 1501).
  - e. +28V IMU STANDBY BUS NOISE RMS shall be less than 1.0 VRMS (CG 1511).
  - f. +28V CMC OPERATE BUS NOISE RMS shall be less than 2.0 VRMS (CG 1521).
  - g. +28V OPTX OPERATE BUS NOISE RMS shall be less than 2.0 VRMS (CG 1531).
- 6.2.4.18 The noise peaks of the following signals are demonstrated on the event light when the peaks have a rise time between 2 and 50 usec and the peak voltage exceeds 5 volts.

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- 6.2.4.18(Cont)
- a. +14V CMC SUPPLY NOISE PEAKS (CG 1022)
  - b. +4V CMC SUPPLY NOISE PEAKS (CG 1032)
  - c. +120 VDC PIPA SUPPLY NOISE PEAKS (CG 1043)
  - d. +4 VDC CDU SUPPLY NOISE PEAKS (CG 1072)
  - e. +28V IMU OPERATE BUS NOISE PEAKS (CG 1502)
  - f. +28V IMU STANDBY BUS NOISE PEAKS (CG 1512)
  - g. +28V CMC OPERATE NOISE PEAKS (CG 1522)
  - h. +28V OPTX OPERATE NOISE PEAKS (CG 1532)

6.2.4.19 If Optics Testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.

6.2.5 General Turn Off and Turn On Procedure

NOTE: The procedure shall be utilized any time after performing 6.2.1, Standby Power On Test and 6.2.3, Operate Power On Test to turn on or turn off the G&N Systems. Appropriate portions of this procedure will be referenced in other tests.

6.2.5.1 Turn Off Procedure.

CAUTION: This procedure must be performed in the sequence specified. Failure to adhere to this sequence may require calibration of the inertial components.

6.2.5.1.1 Enter the following sequence into the K-148.

- a. VERB 41 NOUN 20, ENTER
- b. +00000 ENTR
- c. +00000 ENTR
- d. +09000 ENTR

Verify that the GIMBAL LOCK indicator on the DSKY's is illuminated. On the G&N Indicator Control Panel verify PGNS light is ON. On the DSKY verify NO ATT light is ON.

6.2.5.1.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the following switches on the G&N Indicator Control Panel to the positions designated.

- a. OPTICS ZERO to ZERO
- b. OPTICS MODE to MANUAL
- c. OPTICS COUPLING to DIRECT
- d. OPTICS SPEED to MED
- e. OPTICS TEL TRUN to SLAVE to EXT
- f. RETICLE BRIGHTNESS to minimum brightness position

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- 6.2.5.1.3 Set the G/N Power - IMU switch on the LEB Lighting Control Panel to OFF and G&N IMU MN A and MN B circuit breakers on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).
- 6.2.5.1.3.1 On K-148 enter the following:
- |         |         |              |
|---------|---------|--------------|
| VERB 21 | NOUN 01 | ENTER        |
| 00034   |         | ENTER        |
| 00000   |         | ENTER, ENTER |
| 00760   |         | ENTER        |
| 40000   |         | ENTER        |
- Verify that NO ATT and GIMBAL LOCK lamp indications are OFF.
- 6.2.5.1.4 Set the G&N Power AC1-OFF-AC2 Switch on the Right Hand Circuit breaker panel to OFF and the G&N POWER AC1 and AC2 circuit breakers to OFF (breakers pulled out).
- 6.2.5.1.5 Decrease the LIGHTS - NUMERICS controls on both the Left Hand Circuit Breaker panel and the LEB Lighting Control Panel to the minimum brightness - OFF position.
- 6.2.5.1.6 Set the PSAAM power switch on the PSAAM to OFF.
- 6.2.5.1.7 Set the IMU HTR MN A and MN B circuit breaker on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).
- 6.2.5.1.8 Set the G&N POWER - OPTICS switch on the LEB Lighting Control Panel to OFF and G&N OPTICS MN A and MN B breakers on the Right, Hand Circuit breaker panel to OFF.
- 6.2.5.1.9 Set the COMPUTER MN A and MN B Circuit breakers on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).
- 6.2.5.1.10 Verify that the PTC is supplying inertial components heater power to the G&N System. This will be indicated by the following on the PTC.
- G&N ON (PTC inhibit) light not illuminated.
  - IMU Temp/heater current meter indicates IMU temperature of 130°±5°F.
- 6.2.5.2 Turn ON Procedure
- 6.2.5.2.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set or verify the following G&N Indicator Control Panel switches to the position indicated.



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- 6.2.5.2.1(Cont) a. CONDITION LAMPS to ON  
b. OPTICS ZERO to ZERO  
c. OPTICS MODE to MANUAL  
d. OPTICS COUPLING to DIRECT  
e. OPTICS SPEED to LO  
f. OPTICS TEL TRUN to SLAVE to EXT  
g. RETICLE BRIGHTNESS to minimum brightness position.
- 6.2.5.2.2 Insure that interfacing system EPS and ECS are turned on and operating properly.
- CAUTION: The remaining procedure must be followed in sequence specified. Failure to adhere to this sequence may require recalibration of the inertial components.
- 6.2.5.2.3 Energize the G&N COMPUTER MNA and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Press the STBY pushbutton on the DSKY for approximately 3 seconds. Verify +14 and +4 VDC AGC power supply outputs on CRT display. Voltages shall be +14±0.4V (CG1020) and +4±0.2 (CG1030). On DSKY verify TEMP light is ON. On the G&N Indicator Control Panel verify PGNS light is ON.
- 6.2.5.2.4 Set the G&N POWER AC1 and AC2 breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in). Set the G&N POWER AC1-OFF-AC2 switch to AC1.
- 6.2.5.2.4.1 Set the G&N DSKY and Display Panel brightness to the minimum acceptable level by manipulation of LIGHTS - NUMERICS control on both Left Hand Circuit breaker panel and LEB Lighting Control panel.
- 6.2.5.2.5 Energize the G&N IMU HTR, MNA and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Insure that the CMC +28 VDC discrete lamp on the Event Module is illuminated (CG 1523). Verify TEMP light on DSKY is extinguished. Verify PGNS light on the G&N Indicator Control Panel is extinguished.
- 6.2.5.2.5.1 Set/Verify the following switches on the PSAAM:
- a. PSAAM POWER to ON  
b. INHIBIT VOLTAGE FAIL to OFF
- 6.2.5.2.6 Enter VERB 36 into K-148. Press ENTER pushbutton. Press ERROR RESET pushbutton on K-148. All computer alarms on the Main Display Console (MDC) and LEB AGC DSKY shall clear. Verify that DSKY R1, R2, R3, VERB, NOUN and PROG indications are blank.
- 6.2.5.2.7 Deleted.

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- 6.2.5.2.8 Initiate CMC self-check by entering the following sequence into the K-148:
- a. VERB 21 NOUN 27, ENTER
  - b. 77777, ENTER
  - c. VERB 15 NOUN 01, ENTER
  - d. 1366, ENTER
- 6.2.5.2.8.1 Monitor DSKY until R2 (SCOUNT +1) increments twice. If an error is detected, the PROGRAM ALARM lamp on the DSKY's shall light.
- 6.2.5.2.8.2 Terminate the monitor routine by entering the following into the DSKY:
- VERB 34, ENTER.
- 6.2.5.2.8.3 Enter the following into the K-148:
- a. VERB 21
  - b. NOUN 27 ENTER
  - c. 00000, ENTER
- NOTE: Allow 2 hours to elapse before proceeding to 6.2.5.2.9 with the following exceptions:
- a. If the G&N System has been in the power off state for less than 5 days with the gimbals in the parked position (0°, 0°, 90°) and the system has not been moved, allow 15 minutes to elapse before proceeding.
  - b. If the G&N System has been turned off with the gimbals in the unparked position for less than 2 hours allow a warmup time equal to the time off but not less than 15 minutes to elapse before proceeding.
- CAUTION: If the requirements of 6.2.5.2.10 are not met, remove IMU Operate Power immediately by setting the G/N POWER-IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.5.2.9 After the required warmup time has elapsed set the G&N IMU MN A and MN B circuit breaker on the Right Hand circuit breaker panel to ON (breaker pushed in), and the G/N POWER - IMU switch on the LEB Lighting Control panel to the IMU position (toggle up).
- 6.2.5.2.10 Immediately begin monitoring the following measurements.
- a. On the CRT verify that IMU Operate Power is +28.8±3 VDC (CG 1500).

- 6.2.5.2.10 (Continued) b. On the meter modules verify that oscillations are not sustained and that a null is achieved within 10 seconds of power application on the following measurements:

|         |                           |
|---------|---------------------------|
| CG 2112 | IG 1X Resolver Output Sin |
| CG 2142 | MG 1X Resolver Output Sin |
| CG 2172 | OG 1X Resolver Output Sin |

- c. On the CRT verify the absence of the +120 VDC PIPA Supply (CG 1040) for a period of 90±10 seconds following power application. After approximately 100 seconds, the voltage shall read +120±6 VDC.

- 6.2.5.2.11 Verify that the PROGRAM ALARM lamp on the DSKY's does not light.
- 6.2.5.2.12 Enter and verify VERB 40, NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.5.2.13 Enter and verify VERB 41, NOUN 20 into K148. Press the ENTER pushbutton to advance the System to the Coarse Align mode. The VERB-NOUN display on the CRT shall flash and indicate 21-22.
- 6.2.5.2.14 Enter and verify +00000 into K148 three times, pressing the ENTER pushbutton on the K-148 after each entry.
- 6.2.5.2.15 Set the G&N OPTICS MN A and MN B circuit breakers on the Right Hand Circuit breaker panel to the ON position (breaker pushed in).
- 6.2.5.2.16 Verify that the CRT indications of the signals in Table VI are not flashing.

Table VI. Secondary Power Supply Voltages

| Measurement Number | Signal                     |
|--------------------|----------------------------|
| 1 CG 1040          | +120 VDC PIPA SUPPLY       |
| 2 CG 1051          | +20 VDC PIPA SUPPLY        |
| 3 CG 1052          | -20 VDC PIPA SUPPLY        |
| 4 CG 1070          | +4 VDC CDU SUPPLY          |
| 5 CG 1100          | -28 VDC ELECTRONICS        |
| 6 CG 1020          | +14 VDC CMC SUPPLY         |
| 7 CG 1030          | VDC CMC SUPPLY             |
| 8 CG 1201          | IMU 28V 800 CPS 1 pct 0 ph |
| 9 CG 1202          | IMU 28V 800 CPS 5 pct ph A |
| 10 CG 1203         | IMU 28V 800 CPS 5 pct ph B |
| 11 CG 1331         | 3.2 KC 28V SUPPLY          |
| 12 CG 1110         | 2.5 VDC TM BIAS            |
| 13 CG 2301         | IRIG TEMPERATURE           |

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- 6.2.5.2.17 Monitor the PIPA Display Scope to insure that each PIPA is moding properly.
- 6.2.5.2.18 Perform 6.2.6 G&N Operational Test.
- 6.2.6 G&N Operation Test
- 6.2.6.1 Initial Conditions
- 6.2.6.1.1 Deleted.
- 6.2.6.1.2 Deleted.
- 6.2.6.1.3 Deleted.
- 6.2.6.1.4 Deleted.
- 6.2.6.2 Test Initiation
- 6.2.6.2.1 Enter VERB 92 into K148. Press the ENTER pushbutton.
- 6.2.6.2.2 Enter 00004 into K148. Press the ENTER pushbutton.
- 6.2.6.2.3 The NO ATT discrete shall appear momentarily then go OFF. Verify that the PROGRAM display on the CRT indicates 07.
- NOTE: During this portion of the test the G&N System is exercised through its modes. Any failure will be indicated by the PROGRAM ALARM lamp on the DESKY's lighting.
- 6.2.6.2.4 After approximately 12 minutes, VERB 06, NOUN 96 will flash and the value of the gravity vector in  $\text{cm/sec}^2$  shall be displayed in R1 and R2 on the CRT. Record these values.
- 6.2.6.2.5 R1 contains the first five digits of the gravity vector and R2 contains the last five digits. A decimal point shall be between them. The value for the gravity vector shall be  $980.00000 \pm 05.00000 \text{ cm/sec}^2$ .
- 6.2.6.2.6 Enter VERB 33 into K148. Press the ENTER pushbutton.
- 6.2.6.2.7 When VERB 06 NOUN 96 flashes the value of the horizontal earth rate shall be displayed in R1 and R2 on the CRT. Record these values.
- 6.2.6.2.8 R1 contains the first five digits of earth rate and R2 contains the last five digits. A decimal point shall be placed between them. R1 shall always be 00000. The horizontal earth rate shall be  $00000.88000 \pm 0.1000 \text{ earth rate units}$ .

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- 6.2.6.3.1 Enter VERB 36 into K148. Press the ENTER pushbutton.
- 6.2.6.3.2 Enter VERB 41, NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.6.3.3 Enter +00000 into K148 three times. Press the ENTER pushbutton after each entry.
- 6.2.7 Gimbal Friction Test
- 6.2.7.1 Deleted.
- 6.2.7.1.1 Enter the following into the K-148:
- |         |         |       |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +17000  | ENTER   |       |
| +17000  | ENTER   |       |
| +17000  | ENTER   |       |
- 6.2.7.1.2 Verify on the CRT that R1 = +17000, R2 = +17000 and R3 = +17000. Wait 15 seconds and enter the following into the K-148:
- |         |         |       |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +27000  | ENTER   |       |
| +27000  | ENTER   |       |
| +27000  | ENTER   |       |
- 6.2.7.1.3 Verify on the CRT that R1 = +27000, R2 = +27000 and R3 = +27000. Wait 15 seconds and enter the following:
- |         |         |       |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +00000  | ENTER   |       |
| +00000  | ENTER   |       |
| +00000  | ENTER   |       |
- 6.2.7.1.4 Verify on the CRT that R1 = +00000, R2 = +00000 and R3 = +00000. Wait 15 seconds before proceeding.
- 6.2.7.2 Inner Gimbal Friction Test
- 6.2.7.2.1 Setup the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):
- |            |                           |
|------------|---------------------------|
| a. CG 2120 | IG TORQUE MOTOR CURRENT   |
| b. CG 2117 | IGA SERVO ERROR IN PHASE  |
| c. CG 2112 | IG 1X RESOLVER OUTPUT SIN |
| d. CT 2113 | IG 1X RESOLVER OUTPUT COS |
| e. CG 2220 | IGA CDU FINE ERROR        |
| f. CG 2221 | IGA CDU Coarse Error      |

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- 6.2.7.2.2 Enter the following sequence into the K-148, pushing the ENTER pushbutton after each entry (+360 IG torquing).
- |            |         |           |
|------------|---------|-----------|
| a. VERB 21 | NOUN 01 | ENTR      |
| b. 02500   |         | ENTR      |
| c. 00000   |         | ENTR      |
| d. NOUN 16 |         | ENTR      |
| e. 00000   |         | ENTR/ENTR |
| f. 40000   |         | ENTR/ENTR |
| g. 40034   |         | ENTR/ENTR |
| h. 00000   |         | ENTR/ENTR |
| i. 00000   |         | ENTR      |
- 6.2.7.2.3 Enter the following sequence into K-148:
- VERB 42, press ENTER
  - VERB 33, press ENTER
- 6.2.7.2.4 Start analog recorders.
- 6.2.7.2.5 Verify that IG Servo Error Quadrature (CG 2108) is 0.041.2 V rms. Observe measurement CG 2112, IG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.
- 6.2.7.2.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- VERB 40, NOUN 20, press ENTER
  - VERB 41, NOUN 20, press ENTER
  - +00000, press ENTER
  - +00000, press ENTER
  - +00000, press ENTER
- 6.2.7.2.7 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.2.8 Enter the following sequence into the K-148. Push the ENTER push button after each entry (+360° IG torquing):
- VERB 24 NOUN 01 ENTR
  - 02502, ENTR
  - 37777, ENTR
  - 37743, ENTR
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.

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- 6.2.7.2.9 Enter the following sequence into K-148:
- a. VERB 42, press ENTER
  - b. VERB 33, press ENTER
- 6.2.7.2.10 Start analog recorders.
- 6.2.7.2.11 Observe measurement CG 2112, OG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.
- 6.2.7.2.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-148:
- a. VERB 40, NOUN 20, press ENTER
  - b. VERB 41, NOUN 20, press ENTER
  - c. +00000, press ENTER
  - d. +00000, press ENTER
  - e. +00000, press ENTER
- 6.2.7.2.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.3 Outer Gimbal Friction Test.
- 6.2.7.3.1 Setup the ACE Analog Recorders to record the following measurements (see speed of 10 mm/sec):
- a. CG 2160 OG TORQUE MOTOR CURRENT
  - b. CG 2177 OGA SERVO ERROR IN PHASE
  - c. CG 2172 OG 1X RESOLVER OUTPUT SIN
  - d. CG 2173 OG 1X RESOLVER OUTPUT COS
  - e. CG 2280 OGA CDU FINE ERROR
  - f. CG 2281 OGA CDU Coarse Error
- 6.2.7.3.2 Enter the following sequence into the K-148. Pushing the ENTER pushbutton after each entry (+360° OG torquing):
- a. VERB 24 NOUN 01, ENTER
  - b. 02500, ENTER
  - c. 40000, ENTER
  - d. 40034, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.

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- 6.2.7.3.3 Enter the following sequence into K-148:
- a. VERB 42, press ENTER
  - b. VERB 33, press ENTER
- 6.2.7.3.4 Start analog recorders
- 6.2.7.3.5 Observe measurement CG 2172, OG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.
- 6.2.7.3.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-148:
- a. VERB 40, NOUN 20, press ENTER
  - b. VERB 41, NOUN 20, press ENTER
  - c. +00000, press ENTER
  - d. +00000, press ENTER
  - e. +00000, press ENTER
- 6.2.7.3.7 Verify that OG Servo Error Quadrature (CG 2168) is 0.01±1.2 V rms. Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.3.8 Enter the following sequence into the K-148. Push the ENTER pushbutton after each entry (~360° OG torquing):
- a. VERB 24 NOUN 01, ENTER
  - b. 02500, ENTER
  - c. 37777, ENTER
  - d. 37743, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.3.9 Enter the following sequence into K-148:
- a. VERB 42, press ENTER
  - b. VERB 33, press ENTER
- 6.2.7.3.10 Start analog recorders.
- 6.2.7.3.11 Observe measurement CG 2172, OG 1X resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorder.



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- 6.2.7.3.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-148:
- a. VERB 40, NOUN 20, press ENTER
  - b. VERB 41, NOUN 20, press ENTER
  - c. +00000, press ENTER
  - d. +00000, press ENTER
  - e. -06750, press ENTER
- 6.2.7.3.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = -06750. Wait 30 seconds before proceeding.
- 6.2.7.4 Middle Gimbal Friction Test.
- 6.2.7.4.1 Set up the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):
- a. CG 2150 MG TORQUE MOTOR CURRENT
  - b. CG 2147 MGA SERVO ERROR IN PHASE
  - c. CG 2142 MG 1X RESOLVER OUTPUT SIN
  - d. CG 2143 MG 1X RESOLVER OUTPUT COS
  - e. CG 2250 MGA CDU FINE ERROR
  - f. CG 2251 MGA CDU Coarse Error
- 6.2.7.4.2 Enter the following sequence into the K-148. Push the ENTER pushbutton after each entry (+135° MG torquing):
- a. VERB 24, NOUN 01, ENTER
  - b. 02504, ENTER
  - c. 63777, ENTER
  - d. 77777, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.4.3 Enter the following sequence in the K-148:
- a. VERB 42, press ENTER
  - b. VERB 33, press ENTER
- 6.2.7.4.4 Start the analog recorder.
- 6.2.7.4.5 Verify that MG Servo Error Quadrature (CG 2138) is 0.0±1.2 V rms. Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs (approximately 5 minutes), stop the recorders.

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- 6.2.7.4.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- a. VERB 40 NOUN 20, ENTER
  - b. VERB 41 NOUN 20, press ENTER
  - c. +00000, press ENTER
  - d. +00000, press ENTER
  - e. +00750, press ENTER
- 6.2.7.4.7 Enter the following sequence into the K-148. Push ENTER pushbutton after each entry (-135° MG torquing):
- a. VERB 24 NOUN 01, ENTER
  - b. 02504, ENTER
  - c. 14000, ENTER
  - d. 00000, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.4.8 Enter the following sequence in the K-148:
- a. VERB 42, press ENTER
  - b. VERB 33, press ENTER
- 6.2.7.4.9 Start analog recorders.
- 6.2.7.4.10 Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When the steady-state condition occurs (approximately 5 minutes), stop the recorders.
- 6.2.7.4.11 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- a. VERB 40 NOUN 20, press ENTER
  - b. VERB 41 NOUN 20, press ENTER
  - c. +00000, press ENTER
  - d. +00000, press ENTER
  - e. +00000, press ENTER
- 6.2.7.5 Examine the traces of the recorded measurements for all six phases of this test to detect any sharp discontinuities. Disregard transients of 0.5 second duration or less on the Gimbal Torque motor current traces, disregard transients on the CDU fine error measurement traces. The Gimbal Torque motor currents shall not exceed 0.125 amperes. The CDU Fine Error measurements shall not exceed 400 mv rms. The CDU Coarse Error measurement shall not exceed 2000 mv rms.

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- 6.2.8 G&N Panel Brightness and Lamp Test.
- 6.2.8.1 Proceed with this test if 6.2.5.2 or 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2 before proceeding with this test.
- 6.2.8.2 Rotate the RETICLE BRIGHTNESS thumbwheel on the Control Indicator Panel and verify the capability to control the illumination of the following lamps:
- a. SCT reticles
  - b. SXT reticles
  - c. Telescope Panel Angle Counters
- 6.2.8.3 Turn on LIGHTS-INTEGRAL control on Left Hand Circuit Breaker panel and LEB Lighting Control Panel.
- 6.2.8.4 Adjust the brightness controls on the LEB Lighting Control Panel and Left Hand Circuit Breaker Panel from minimum brightness to maximum brightness. Verify the operation of the G&N Indicator Control Panel lamps.
- 6.2.8.4.1 Re-adjust brightness controls for minimum acceptable lighting. Turn off LIGHTS-INTEGRAL control on Left Hand Circuit Breaker panel and LEB Lighting Control Panel.
- 6.2.8.5 Push and hold the CONDITION LAMPS switch on the G&N Indicator Control Panel to TEST. Verify the illumination of the following lamps:
- a. STAR ACQ
  - b. MASTER ALARM lamp
- 6.2.8.6 Set the CONDITION LAMPS switch to ON. Lamps a and b in 6.2.8.5. shall extinguish.
- 6.2.9 Semi-Automatic Moding Check
- Proceed with this test if 6.2.3 has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 before proceeding with this test.
- 6.2.9.1 Test Initiation
- 6.2.9.1.1 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify OPTX BUS, 28V 800 1% and 5% Power Supplies.

6.2.9.1.2 Enter VERB 92 into K148. Press the ENTER pushbutton.

6.2.9.1.3 Enter 00010 into K148. Press the ENTER pushbutton.

6.2.9.1.4 After approximately 5 seconds observe VERB 06 NOUN 01 flashing on the CRT and Program display indicates 07.

6.2.9.2 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall light. After approximately 30 seconds the following data shall be displayed on the CRT.

a. VERB 06 NOUN 03 flashing

b.  $R1 = +00000 \pm 00007$

c.  $R2 = +00000 \pm 00007$

d.  $R3 = +00000 \pm 00007$

e. IG angle =  $000 \pm 3$  deg.

f. MG angle =  $000 \pm 3$  deg.

g. OG angle =  $000 \pm 3$  deg.

6.2.9.3 Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.

a. VERB 06 NOUN 03 flashing

b.  $R1 = +04500 \pm 00007$

c.  $R2 = +04500 \pm 00007$

d.  $R3 = +04500 \pm 00007$

e. IG angle =  $045 \pm 3$  deg.

f. MG angle =  $045 \pm 3$  deg.

g. OG angle =  $045 \pm 3$  deg.

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- 6.2.9.4 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.
- a. VERB 05 NOUN 97 flashing
  - b. R1 = 00000 ± 00003
  - c. R2 = 00000 ± 00003
  - d. R3 = 00000 ± 00003
- NOTE: Negative numbers will be displayed in octal complement form, i.e., -00001 = 77776.
- 6.2.9.5 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS Caution Lamp on the Indicator Control Panel shall light.
- a. VERB 06 NOUN 05 flashing
  - b. R1 = +07100±00007
  - c. R2 = +07100±00007
  - d. R3 = +07100±00007
  - e. IG angle = 071±3 deg
  - f. MG angle = 071±3 deg
  - g. OG angle = 071±3 deg
- The GIMBAL LOCK lamps on the DSKY's shall light.
- 6.2.9.6 Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 06 Flashing
  - b. R1 = +09000±00007
  - c. R2 = +09000±00007
  - d. R3 = +09000±00007
  - e. IG angle = 090±3 deg
  - f. MG angle = 090±3 deg
  - g. OG angle = 090±3 deg
- 6.2.9.7 Enter VERB 33 and Press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 07
  - b. R1 = +13500±00007
  - c. R2 = +13500±00007

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- 6.2.9.7 (Cont) d. R3 = +13500±00007  
e. IG angle = 135±3 deg  
f. MG angle = 135±3 deg  
g. OG angle = 135±3 deg
- 6.2.9.8 Enter VERB 33 and press ENTER. After approximately 20 seconds VERB 06 NOUN 8 shall flash. The GIMBAL LOCK lamp shall extinguish on the DSKY's. The PGNS Caution lamp on the Indicator Control Panel shall extinguish. The gimbal angles as displayed in R1, R2 and R3 shall be approximately 135 deg, 135 deg and 45 deg, respectively.
- 6.2.9.9 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.
- a. VERB 05 NOUN 97 flashing  
b. R1 = 00000±00003  
c. R2 = 00000±00003  
d. R3 = 00000±00003
- 6.2.9.10 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS caution lamp on the Indicator Control Panel shall light.
- a. VERB 06 NOUN 10 flashing  
b. R1 = +22500±00007  
c. R2 = +22500±00007  
d. R3 = +22500±00007  
e. IG angle = 225±3 deg.  
f. MG angle = 225±3 deg.  
g. OG angle = 225±3 deg.
- The GIMBAL LOCK lamp on the DSKY's shall light.
- 6.2.9.11 Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS caution lamp on the Indicator Control Panel shall extinguish.
- a. VERB 06 NOUN 11 flashing  
b. R1 = +22500±00007  
c. R2 = +22500±00007  
d. R3 = +31500±00007  
e. IG angle = 225±3 deg.  
f. OG angle = 225±3 deg.  
g. MG angle = 315±3 deg.
- The GIMBAL LOCK lamp on the DSKY shall extinguish.

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- 6.2.9.12 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.
- a. VERB 05 NOUN 97 flashing
  - b. R1 = 00000±00003
  - c. R2 = 00000±00003
  - d. R3 = 00000±00003
- 6.2.9.13 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 13 flashing
  - b. R1 = +31500±00007
  - c. R2 = +31500±00007
  - d. R3 = +31500±00007
  - e. IG angle = 315±3 deg.
  - f. MG angle = 315±3 deg.
  - g. OG angle = 315±3 deg.
- 6.2.9.14 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.
- a. VERB 05 NOUN 97 flashing
  - b. R1 = 00000±00003
  - c. R2 = 00000±00003
  - d. R3 = 00000±00003
- 6.2.9.15 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNE-Caution lamp on the Indicator Control Panel shall light.
- a. VERB 06 NOUN 15 flashing
  - b. R1 = +28900±00007
  - c. R2 = +28900±00007
  - d. R3 = +28900±00007
  - e. IG angle = 289±3 deg.
  - f. OG angle = 289±3 deg.
  - g. MG angle = 289±3 deg.
- The GIMBAL LOCK lamp on the DSKY's shall light.

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6.2.9.16 Enter VERB 33 and press ENTER. After approximately 20 seconds the following data will be displayed on the CRT. The PGNS Caution lamp on the Indicator Control Panel shall extinguish.

- a. VERB 06 NOUN 16 flashing
- b. R1 = +00000±00007
- c. R2 = +00000±00007
- d. R3 = +00000±00007
- e. IG angle = 000±3 deg.
- f. MG angle = 000±3 deg.
- g. OG angle = 000±3 deg.

The GIMBAL LOCK lamp on the DSKY's shall extinguish.

6.2.9.17 Enter VERB 33 and press ENTER. The COMPACTY lamp on the DSKY's shall flash for a few seconds. After approximately 15 seconds the following data shall be displayed on the CRT.

- a. VERB 06 NOUN 98 flashing
- b. R1 = 000xx
- c. R2 = xxxxx

The GIMBAL LOCK lamp on the DSKY's shall light. The PGNS Caution lamp on the Indicator Control Panel shall light.

Record R1 and R2 as the Middle Gimbal CDU drive rate. MG rate =  $\frac{R1 \cdot R2}{\text{sec}}$ . The Middle Gimbal CDU drive rate shall be 14±2°/sec.

6.2.9.18 Enter VERB 33 into K148. Press the ENTER pushbutton. After approximately 30 seconds the following data shall be displayed on the CRT.

- a. VERB 06 NOUN 98 flashing
- b. R1 = 000xx
- c. R2 = xxxxx

The GIMBAL LOCK lamp on the DSKY's shall extinguish. The PGNS Caution lamp on the Indicator Control Panel shall extinguish.

Record R1 and R2 as the Inner Gimbal CDU drive rate. IG rate =  $\frac{R1 \cdot R2}{\text{sec}}$ . The Inner Gimbal CDU drive rate shall be 14±2°/sec.



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- 6.2.9.19 Enter VERB 33 into K148. Press the ENTER pushbutton. After approximately 30 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98 flashing
  - b. R1 = 000xx
  - c. R2 = xxxx
- Record R1 and R2 as the Outer Gimbal CDU drive rate.  
OG rate =  $\frac{R1}{R2} \cdot \frac{R2}{sec}$ . The Outer Gimbal CDU drive rate shall be 1442"/sec.
- 6.2.9.20 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall extinguish. After approximately 20 seconds VERB 21 NOUN 22 shall flash on the CRT. Enter +00100 into K148 three times. Press the ENTER pushbutton after each entry. The NO ATT lamp on the DSKY's shall momentarily light, then extinguish. After approximately 100 seconds VERB 01 NOUN 10 flashing shall be displayed on the CRT. Press the ENTER pushbutton.
- Verify R1 = 33xxx.
- The ISS WARNING Lamp on the Indicator Control Panel shall light.  
The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be ON.
- 6.2.9.21 Enter VERB 33 into K148. Press the ENTER pushbutton. ISS WARNING and ISS CDU FAIL shall be OFF. After approximately 20 seconds VERB 21 NOUN 22 shall flash on the CRT. Enter +03375 into K148 three times. Press the ENTER pushbutton after each entry. The NO ATT lamp on the DSKY's shall momentarily light, then extinguish. After approximately 100 seconds VERB 01 NOUN 10 flashing shall be displayed on the CRT. Press the ENTER pushbutton.
- Verify R1 = 33xxx.
- The ISS WARNING lamp on the Indicator Control Panel shall light.  
The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be ON.
- 6.2.9.22 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds VERB 06 NOUN 91 shall flash on the CRT. The ISS WARNING lamp on the Control Indicator Panel shall extinguish. The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be OFF.
- 6.2.9.23 CAUTION; See paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS MODE switch to CMC.
- 6.2.9.24 Enter VERB 33, press ENTER. After approximately 25 seconds the following data shall be displayed on the CRT.

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- 6.2.9.24(Cont) a. VERB 06 NOUN 98 flashing  
b. R1 = 000xx  
c. R2 = xxxxx
- Record R1 and R2 as the Shaft Optics CDU drive rate.  
Shaft rate =  $R1 \cdot R2$ . The Shaft Optics CDU drive rate shall be  $15.10 \pm 3.78^\circ/\text{sec}$ .
- 6.2.9.25 Enter VERB 33 into K148. Press the ENTER pushbutton. In about 15 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98  
b. R1 = 0000x  
c. R2 = xxxxx
- Record R1 and R2 as the Trunnion Optics CDU drive rate. Trunnion rate =  $R1 \cdot R2$ . The Trunnion Optics CDU drive rate shall be  $3.77 \pm 0.94^\circ/\text{sec}$ .
- 6.2.9.26 Terminate the Semi-Automatic Moding Check by entering VERB 34 into K148. Observe PROG display on DSKY's is 00. Press the ENTER pushbutton. If Optics testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Panel to OFF.
- 6.2.10 Zero Optics Test
- 6.2.10.1 Set the G&N POWER-OPTICS switch on the LEB to OPTICS. Verify Power supplies.
- NOTE: Proceed with this test if 6.2.3 Operate Power on test has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2. Turn On Procedure before proceeding.
- INITIALIZATION
- 6.2.10.2 Insure that the following switches on the G&N Indicator Control Panel are set as follows:
- a. OPTICS TEL TRUN to SLAVE to SXT  
b. OPTICS COUPLING to DIRECT  
c. OPTICS SPEED to HI  
d. OPTICS MODE to MAN
- OPTICS ZERO MODE TEST
- 6.2.10.3 Monitor the Optics CDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton.

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6.2.10.4 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Verify the Optics ~~has~~ moved properly by observing the following on R1 and R2 of the CRT.

- a. R1 =  $+0.00^{\circ} + 0.02^{\circ}$ ,  $-0.03^{\circ}$  (Shaft Angle)
- b. R2 =  $+0.000^{\circ} + 0.006^{\circ}$ ,  $-0.007^{\circ}$  (Trunnion Los Angle)

6.2.10.4.1 Enter the following:

VERB 01 NOUN 10, ENTER  
00033 ENTER

Verify R1 = XXX6X

6.2.10.4.2 Set the OPTICS ZERO switch to OFF and the OPTICS MODE switch to CMC. Enter the following:

ENTER  
00033, ENTER

Verify R1 = XXX5X

6.2.10.4.3 Set the OPTICS MODE switch to MAN. Press the KEY-REL pushbutton.

OPTICS TIME TO ZERO TEST

6.2.10.5 Deleted.

6.2.10.6 Deleted.

6.2.10.7 Deleted.

6.2.10.8 Deleted.

6.2.10.9 Deleted.

6.2.10.10 Deleted.

6.2.10.11 Deleted.

OPTICS BACKUP MODE TEST

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- 6.2.10.12 Insert the Inflight Tool (V36601405) into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eyepiece while turning the tool until the TPAC reads +5°. Remove the tool from the Trunnion tool input.
- 6.2.10.13 Insert the Inflight Tool (V36601405) into the Shaft Tool input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool.
- 6.2.10.14 Insert the Inflight Tool (V36601405) into the Trunnion Tool input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool.
- 6.2.11 OPTICS Coordinate Transformation Control Test.
- 6.2.11.1 Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.
- NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding.
- INITIALIZATION
- 6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.
- a. OPTICS TEL TRUN to SLAVE to EXT
  - b. OPTICS COUPLING to DIRECT
  - c. OPTICS SPEED to HI
  - d. OPTICS MODE to MAN
- 6.2.11.3 Enter the following into the K-148.
- VERB 16 NOUN 91 ENTR
- 6.2.11.3.1 Deleted.
- 6.2.11.3.1.1 Deleted.
- 6.2.11.3.1.2 Deleted.

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- 6.2.11.4 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS ZERO switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS ZERO switch to OFF.
- 6.2.11.5 Set up the analog recorders to monitor the following measurements:
- a. CG 3170 SCT Trunnion Tachometer Output.
- RESOLVED MODE PHASING AND IMAGE RATE TEST.
- 6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until  $R1 = +225.00$  and  $R2 = +10.000$  on the CRT and the DSKY's.
- 6.2.11.7 Set the OPTICS COUPLING switch on the G&N Panel to RSLV and the OPTICS Speed switch to MED.
- 6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.
- 6.2.11.9 Record time. Quickly displace the OPTICS CONTROL STICK  $45 \pm 10$  degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at  $45 \pm 10$  deg. When target leaves the SCT upper right field of view press MARK pushbutton. The PROG alarm light shall light.
- 6.2.11.10 From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) and the PROG alarm discrete for the period during which the OPTICS CONTROL STICK was being displaced above. The Shaft CDU angle shall be  $225.00 \pm 10.00$  degrees at the time the PROG alarm occurred. The elapsed time from time of OPTICS CONTROL STICK displacement to the time the PROG alarm discrete is obtained shall be 19 to 32 seconds.
- 6.2.11.11 Set the OPTICS COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the optics until  $R1 = +225.00$  and  $R2 = +10.000$ . Set the OPTICS COUPLING switch to RSLV.
- 6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.

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- 6.2.11.13 CAUTION: See Paragraph 5.2.2.11 before proceeding.  
Set the OPTICS COUPLING switch on the G&N Panel to DIRECT.  
Set the OPTICS ZERO switch to ZERO.
- 6.2.12 OPTICS FUNCTIONAL TEST
- 6.2.12.1 Deleted.
- 6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:
- a. +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8±3 VDC. Record the indication on the CRT.
  - b. CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.
  - c. CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT.
- 6.2.12.3 Deleted
- 6.2.12.4 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Insure that the Optics control switches on the G&N Indicator Control Panel are set as follows:
- a. OPTICS ZERO to ZERO
  - b. OPTICS MODE to MAN
  - c. OPTICS SPEED to LO
  - d. OPTICS COUPLING to DIRECT
  - e. OPTICS TRUN to SLAVE to SXT
- 6.2.12.5 Set OPTICS ZERO switch to OFF.
- 6.2.12.6 Resolution checks
- 6.2.12.6.1 SXT Resolution Check - MSO only
- 6.2.12.6.1.1 Sight through the SXT eyepiece. Using the OPTICS CONTROL STICK, adjust the SXT to obtain the best reflected field of view of the 5-inch autocollimator reticle engravings at the center of view.
- 6.2.12.6.1.2 Note that the autocollimator reticle contains a series of lines of different thickness and width. Each set of lines is marked with a number (20, 15, 10, 7, 5, 3) which indicates the angle subtended by one line and one space. View each set of lines to determine the lowest numbered set in which resolution between lines (ability to distinguish separate distinct lines within a set) can be made. Record the number associated with that set of lines. The SXT resolution shall be at least 10 arc seconds at the center of the field of view.

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- 6.2.12.6.2 SCT Resolution Check
- 6.2.12.6.2.1 Sight through the SCT EYEPIECE. Using the OPTICS CONTROL STICK adjust the SCT to obtain the best view of the SCT RESOLUTION CHART held in the Optics line of sight.
- 6.2.12.6.2.2 Note the chart contains sets of lines. View each set of lines to determine the lowest numbered set in which the resolution between lines (ability to distinguish separate lines within a set) can be made. The SCT shall have a resolution of at least 3 arc minutes at the center of the field of view.
- 6.2.12.7 Slave Telescope Mode Checks
- 6.2.12.7.1 Verify/perform OPTICS POWER ON TEST per paragraph 6.2.3.2.
- 6.2.12.7.2 Set/Verify the following switches on G&N INDICATOR CONTROL PANEL:
- a. OPTICS TEL TRUN - SLAVE to SXT
  - b. OPTICS COUPLING - DIRECT
  - c. OPTICS SPEED - HI
- 6.2.12.7.3 Monitor OCDU's by entering VERB 16 NOUN 91 into K-148. Press ENTER.
- 6.2.12.7.4 Set OPTICS MODE to MAN.
- 6.2.12.7.5 Using the Optics Hand Controller drive the optics until:
- R1 = +000.00±001.00 (SHAFT)  
R2 = +10.000±01.000 (TRUNNION)
- 6.2.12.7.6 Verify on the CRT and Optics Panel:
- SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.7 Set the OPTICS TEL TRUN on the G&N INDICATOR CONTROL PANEL to 0°.
- 6.2.12.7.8 Verify:
- SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = 0.0° ±0.22 DEG
- R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.9 Set the OPTICS TEL TRUN on the G&N INDICATOR CONTROL PANEL TO OFFSET 25°.

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- 6.2.12.7.10 Verify on CRT and Optics Panel:
- SHAFT TPAC =  $R1 \pm 0.11$  DEG  
TRUN TPAC =  $25^\circ \pm 1.00$  DEG  
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.11 On the G&N INDICATOR CONTROL PANEL set the OPTICS TEL TRUN to SLAVE to SXT.
- 6.2.12.7.12 Verify on CRT and Optics Panel:
- SHAFT TPAC =  $R1 \pm 0.11$  DEG  
TRUN TPAC =  $R2 \pm 0.22$  DEG
- 6.2.12.7.13 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
On the G&N INDICATOR CONTROL PANEL set the OPTICS ZERO to ZERO.  
Wait 15 sec.
- 6.2.12.7.14 Verify on CRT and OPTICS PANEL.
- $R1 = 000.00 +000.02, -000.03$   
 $R2 = 00.000 +00.006, -00.007^\circ$
- SHAFT TPAC =  $R1 \pm 0.11$  DEG  
TRUN TPAC =  $R2 \pm 0.22$  DEG
- 6.2.12.7.15 If Optics testing will not be continued, set the G&N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.8 SXT Parallelism Tests
- 6.2.12.8.1 Remove the plug from the base of the SXT eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light.
- NOTE: If needed to reduce external light, place a photographers hood over the optics head.
- 6.2.12.8.2 SXT Auto Collimator Parallelism Test - MSO only.
- 6.2.12.8.2.1 Using the OPTICS CONTROL STICK drive the SXT St LOS Trunnion to  $+15.00^\circ \pm 2^\circ$  as indicated in R2 of the DSKY. Maintain a Shaft CDU angle of  $000.00 \pm 0.10$  degrees.
- 6.2.12.8.2.2 Sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to superimpose the SXT LLOS horizontal reticle image upon the autocollimator horizontal filar. Record the autocollimator reading.



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- 6.2.12.8.2.3 Repeat 6.2.12.8.2.2 twice. Calculate and record the average of the three autocollimator readings.
- 6.2.12.8.2.4 Set the OPTICS ZERO switch to ZERO.
- 6.2.12.8.2.5 Again sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to bring the SXT St LOS horizontal reticle and autocollimator horizontal filar images to coincide. Record the autocollimator reading.
- 6.2.12.8.2.6 Repeat 6.2.12.8.2.5 twice. Calculate and record the average of the three autocollimator readings. The average value obtained here shall not differ from that obtained in 6.2.12.2.3 by more than 10 arc seconds.
- 6.2.12.8.3 Deleted.
- 6.2.12.8.3.1 Deleted.
- 6.2.12.8.3.2 Deleted.
- 6.2.12.8.3.3 Deleted.
- 6.2.12.8.3.4 Deleted.
- 6.2.12.9 SXT, CMC Functional Check
- 6.2.12.9.1 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch to MAN. Set the OPTICS ZERO switch to ZERO. After 15 seconds, return the switch to OFF.
- 6.2.12.9.2 Sight through the SXT. Using the Control Stick align the SXT St LOS with Optical Target No. 1.
- 6.2.12.9.3 When aligned, record the value of the Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.4 Sight through the SXT. Using the Control Stick align the SXT St LOS with Optical Target No. 2.
- 6.2.12.9.5 When aligned, record the value of the Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.6 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. After 15 seconds set the OPTICS ZERO switch to OFF. Set the OPTICS MODE switch to CMC.

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- 6.2.12.9.7 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.3 into the DSKY and press ENTER. Enter the value for Trunnion from 6.2.12.9.3 into the DSKY and press ENTER.
- 6.2.12.9.8 Sight through the SXT. The St LOS should be approximately centered on the Optical Target No. 1. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.3 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.9 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for shaft from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton. Enter the value for Trunnion from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton.
- 6.2.12.9.10 Sight through the SXT. The St LOS should be approximately centered on the Optical Target No. 2. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.11 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds.
- 6.2.12.9.12 If OPTICS testing will not continue, set the G&N Power Optics switch on the LEB Lighting Panel to OFF.
- 6.2.13. Optics Slew Rate Test.
- 6.2.13.1 Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to the positions indicated:
- a. OPTICS TEL TRUN to SLAVE to SXT
  - b. OPTICS COUPLING to DIRECT
  - c. OPTICS SPEED to HI
  - d. OPTICS MODE to MAN.
- 6.2.13.2 Monitor the OCDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton. Insure RECORD DSKY AND RECORD DOWNLINK on R-145 are ON.
- 6.2.13.3 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch on the G&N Indicator Panel to OFF. Set the OPTICS MODE switch to MAN.

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6.2.13.3(Cont) NOTE: Read and understand step 6.2.13.4 before proceeding.  
Do not hold Control Stick at upper limit more than 10 seconds or  
exceed a trunnion angle of 85°.

TRUNNION SLEW RATE - HI SPEED

6.2.13.4 Record time. Push and hold the Optics Control Stick to its upper limit.  
After approximately 7 seconds release the control stick. Record the SXT  
Trunnion Servo Error In-Phase output (CG3118) signal on the CRT while  
slewing the optics. The voltage shall be -0.25 to -2.00 VRMS.

6.2.13.5 Perform the following calculations:

From the Uplink file tape, the compressed data tape or the PCM tape  
request a data reduction of the trunnion CDU register (address 35) and the  
TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the  
7 second period during which the rate test was being performed.

Calculate the slew rate by dividing the  $\Delta$ CDU angle by the elapsed time.

The Trunnion slew rate shall be  $10.0 \pm 2.0$  deg/sec.

SHAFT SLEW RATE - HI SPEED

6.2.13.6 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS  
ZERO switch to OFF.

NOTE: Read and understand step 6.2.13.7 before proceeding. Do not  
hold Control Stick at right limit for more than 10 seconds or  
exceed a shaft angle of 250°.

6.2.13.7 Record time. Push and hold the Optics Control stick to its right limit. After  
approximately 7 seconds release the control stick.

Record the SXT Shaft Servo Error In-Phase Output (CG 3117) signal on the  
CRT while slewing the optics. The voltage shall be -0.25 to -2.00 VRMS.

6.2.13.8 Perform the following calculations:

From the uplink file tape, the compressed data tape or the PCM tape,  
request a data reduction of the Shaft CDU register (address 36) and the  
TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7  
second period during which the rate test was being performed.

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- 6.2.13.8  
(Continued)
- Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.
- The Shaft slew rate shall be  $19.5 \pm 3.9$  deg/sec.
- TRUNNION SLEW RATE - MED SPEED
- 6.2.13.9
- CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS SPEED switch to MED.
- NOTE: Read and understand 6.2.13.10 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.
- 6.2.13.10
- Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick. Record the SXT TRUN MTR Control Winding (CG 3155) and SXT Trun Tach (CG 3150) signals while slewing the optics. CG 3155 shall be  $+0.25$  to  $+2.00$  VRMS. CG 3150 shall be  $+0.33 \pm 0.13$  VRMS.
- 6.2.13.11
- Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the Trunnion CDU registers (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.
- The Trunnion slew rate shall be  $1.0 \pm 0.2$  deg/sec.
- SHAFT SLEW RATE - MED SPEED
- 6.2.13.12
- CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.
- NOTE: Read and understand 6.2.13.13 before proceeding. Do not hold control stick at right limit for more than 20 seconds.
- 6.2.13.13
- Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick. Record the SXT Shaft MTR Control Winding (CG 3145) and SXT Shaft Tach (CG 3140) signals while slewing the optics. CG 3145 shall be  $+0.50$  to  $+4.00$  VRMS. CG 3140 shall be  $0.33 \pm 0.13$  VRMS.

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- 6.2.13.14 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.
- The Shaft slew rate shall be  $2.0 \pm 0.4$  deg/sec.
- TRUNNION SLEW RATE - LO SPEED
- 6.2.13.15 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS SPEED switch to LO.
- NOTE: Read and understand 6.2.13.16 before proceeding. Do not hold control stick at upper limit for more than 30 seconds.
- 6.2.13.16 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.
- 6.2.13.17 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the Trunnion CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.
- The Trunnion slew rate shall be  $0.10 \pm 0.02$  deg/sec.
- SHAFT SLEW RATE - LO SPEED
- 6.2.13.18 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.
- NOTE: Read and understand 6.2.13.18 before proceeding. Do not hold control stick at right limit for more than 30 seconds.
- 6.2.13.19 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.

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- 6.2.13.20 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.
- The Shaft slew rate shall be  $0.20 \pm 0.04$  deg/sec.
- OPTICS HAND CONTROLLER DRIFT RATE CHECK - LO SPEED
- 6.2.13.21 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Record time. Wait 60 seconds.
- 6.2.13.22 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the Trunnion and Shaft CDU registers (addresses 35 and 36 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 60 second period during which the drift rate test was being performed.
- Calculate the drift rate by dividing the  $\Delta$ CDU angles by the elapsed time.
- The Trunnion drift rate shall be less than .0167 deg/sec.
- The shaft drift rate shall be less than .0333 deg/sec.
- 6.2.13.23 If OPTICS testing will not continue; set the G/N Power-Optics switch on the LEB Lighting Control Panel to OFF.

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- 6.2.14 Stabilization Loop Step Response Test
- 6.2.14.1 Proceed with this test if the Operate Power On Test of 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform the Turn ON Procedure of 6.2.5.2 before proceeding.
- 6.2.14.2 Insure that the Carry-on Command Stimuli Unit, Model No. C14-200, is installed and connected.
- 6.2.14.3 Enter VERB 36 into K148. Press the ENTER pushbutton, then the ERROR RESET pushbutton.
- 6.2.14.4 Inner Gimbal Response Test.
- 6.2.14.4.1 Enter code 2032000000 in C-START Module 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2117 IGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.4.2 Enter VERB 41 NOUN 20 into K148. Press ENTER pushbutton.
- 6.2.14.4.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.4.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.4.5 Deleted.
- 6.2.14.4.6 Enter 0001 into R154. Verify and execute to apply +28 VDC ACE ENABLE to the PSAAM.
- 6.2.14.4.7 Enter 1000 into R155. Verify and execute to enter a DC step into the 1G stabilization loop.
- CAUTION: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.4.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.4.9 Enter 0000 into 4A2-A6-R155; the top part of switch should be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the 1G Stabilization Loop. The bottom part of switch shall be extinguished.
- 6.2.14.4.10 After the transient has died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to  $\pm 5\%$  of the original step amplitude. In addition, record the total number of overshoots.

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- 6.2.14.4.10.1 The inner gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.4.10.2 The maximum number of overshoots on the IGA Servo Error signals shall be three.
- 6.2.14.5 Middle Gimbal Response Test
- 6.2.14.5.1 Enter Code 2028000000 into C-START MODULE 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2147 MGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.5.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.5.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.5.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.5.5 Deleted.
- 6.2.14.5.6 Enter 0100 into 4A2-A6-R155. The top part of switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.5.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the MG Stabilization Loop.
- CAUTION: If the transient caused by the step input does not die within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.5.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.5.9 Enter 0000 into 4A2-A6-R155. The top part of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.
- 6.2.14.5.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to  $\pm 5\%$  of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.5.10.1 The middle gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.5.10.2 The maximum number of overshoots on the MGA Servo Error signals shall be three.



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- 6.2.14.6 Outer Gimbal Response Test
- 6.2.14.6.1 Enter code 2026000000 in C-START Module 4A1-A5-C156. Press XEQ/SEAL Pushbutton to call up CG 2177 OGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.6.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.6.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.6.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.6.5 Deleted.
- 6.2.14.6.6 Enter 0010 into 4A2-A6-R155. The top half of the switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.6.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the OG Stabilization Loops.
- NOTE: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.6.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.6.9 Enter 0000 into 4A2-A6-R155. The top half of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the OG Stabilization Loop.
- 6.2.14.6.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to  $\pm 5\%$  of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.6.10.1 The outer gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.6.10.2 The maximum number of overshoots on the OGA Servo Error Signals shall be five.

- 6.2.14.7 Enter VERB 40 NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.14.7.1 Enter VERB 41 NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.14.7.2 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.3 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.4 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.5 Enter 0000 into R154. Verify and execute to remove +28 VDC ACE ENABLE.

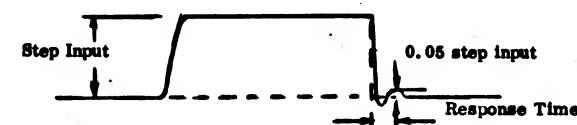


Figure 1. Typical Step Input Response

- 6.2.15 IRIG Scale Factor Test
- 6.2.15.1 Perform Master Initialization 6.2.5.3 before proceeding.
- 6.2.15.2 Verify that the IMU OPERATE power has been applied for a minimum of 1 hour, and that at least 1 hour has elapsed since running of the Gimbal Friction Test, 6.2.7.
- 6.2.15.3 Set up the Analog Recorders to monitor the following signals:
  - a. CG 2117 IG SERVO ERROR
  - b. CG 2147 MG SERVO ERROR
  - c. CG 2177 OG SERVO ERROR
  - d. CG 2120 IG TM CURRENT
  - e. CG 2150 MG TM CURRENT
  - f. CG 2180 OG TM CURRENT
- 6.2.15.3.1 Start the analog recorder chart drive using a chart speed of 1 mm/sec. The recorder shall run for the duration of 6.2.15.
- 6.2.15.4 Enter VERB 92 into K148. Press the ENTER pushbutton.
- 6.2.15.5 Enter 00005 into K148. Press the ENTER pushbutton. Program 07 shall be displayed.

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6.2.15.6 VERB 06 NOUN 41 shall flash on CRT and the following displayed in R1 and R2:

R1 = xxxxxx (some Nav. Base azimuth)  
R2 = xxxxxx (some test site latitude; see Table I)

6.2.15.7 If the values displayed in R1 and R2 are correct, proceed with test, if not perform the following sequence:

- a. To correct T1, on the K-148 enter VERB 21, press ENTER push-button, xxx.xx, press ENTER (xxx.xx is correct nav. base azimuth).
- b. To correct R2, on the K-148 enter VERB 22, press ENTER push-button, xxx.xxx, press ENTER (obtain correct site latitude from Table I).

Verify that the values in R1 and R2 are correct.

TABLE I

| SITE       | LATITUDE |
|------------|----------|
| NAA        | +33.921  |
| MSC        | +29.556  |
| KSC MSO    | +28.523  |
| KSC VAB    | +28.585  |
| KSC PAD 39 | +28.607  |

6.2.15.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
+00001 ENTR

NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.8.

6.2.15.9 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+X IRIG Scale Factor error in part per million, Position +00001).

6.2.15.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
+00002 ENTR

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NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps of 6.2.15.4 through 6.2.15.7 and 6.2.15.10.

6.2.15.11 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor Error in parts per million Position +00002).

6.2.15.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
+00003 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.12.

6.2.15.13 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (-Z IRIG Scale Factor error in parts per million, Position +00003).

6.2.15.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
-00001 ENTR

NOTE: If PROG lamp changes from 06 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 38 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.14.

6.2.15.15 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row (-X IRIG Scale Factor error in parts per million, Position -00001).

6.2.15.16 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
-00002 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.16.

6.2.15.17 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per million, Position -00002).

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- 6.2.15.18 On K-148 enter the following sequence:  
VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
-00003 ENTR
- NOTE: If PROG lamp changes from 07 to 00 during the next step or  
PROG ALARM is ON, enter VERB 36 ENTR and repeat steps  
6.2.15.4 through 6.2.15.7 and 6.2.15.18.
- 6.2.15.19 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and  
record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per  
million, Position -00003).
- 6.2.15.20 Repeat steps 6.2.15.8 through 6.2.15.19 twice to obtain second and  
third set of data.
- 6.2.15.21 Terminate this test by entering in K-148: VERB 34 ENTER
- 6.2.15.22 The average of the three readings of Scale Factor Error for the 6 positions  
shall be 0±1750 PPM.
- 6.2.15.23 After completion of all test numbers, stop the analog recorders.
- 6.2.15.24 Enter VERB 40 NOUN 20, ENTER into K148.
- 6.2.15.25 Enter the following into K148:  
a. VERB 41 NOUN 20 ENTR  
b. +00000, ENTER  
c. +00000, ENTER  
d. +00000, ENTER

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6.2.16 IMU Performance Test

6.2.16.1 Proceed with this test if the Operate Power On Test of 6.2.3 or the Turn On Procedure of 6.2.5.2 has been completed and system operation has not been interrupted. If the system operation has been interrupted, perform Turn On Procedure of 6.2.5.2 before proceeding with this test.

6.2.16.2 Verify that the IMU Operate Power has been applied for at least one hour.

6.2.16.3 On K-148, enter the following:

VERB 92 ENTR

6.2.16.4 Enter 00001 into K-148. Press the ENTER pushbutton.

6.2.16.5 On the CRT DSKY display VERB 06 NOUN 41 shall flash. Verify R1 (Nav Base Azimuth) and R2 (Site Latitude) are correct.

6.2.16.6 If values for R1 and R2 are correct, proceed to next step. If values for R1 and R2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR  
+XXX,XX ENTR (Correct navigation base azimuth  $\pm 0.50$  deg)  
+XX,XXX ENTR (Correct site latitude from Table XX)

Verify values in R1 and R2 are correct.

TABLE XX

| Location | Latitude |
|----------|----------|
| NAA      | +33.921  |
| MSC      | +29.556  |
| KSC-MBO  | +28.523  |
| KSC-VAB  | +28.585  |
| KSC-PAD  | +28.607  |

6.2.16.7 On K-148, enter the following sequence:

VERB 33 ENTR  
VERB 06 NOUN 98 shall flash

6.2.16.8 On CRT DSKY display, verify R1 = +00900 (Time), R2 = +00000 (Test Index No.) and R3 = +00012 (Test Position). If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR  
+00900 ENTR (Test Time in Seconds)  
+00000 ENTR (Test Index Number)  
+00012 ENTR (Test Position Entry)

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- 6.2.16.9 On K-148, enter the following sequence:
- VERB 33 ENTR
- 6.2.16.10 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.11 On K-148, enter the following sequence:
- VERB 34 ENTR  
VERB 06 NOUN 98 shall flash
- 6.2.16.12 On CRT DSKY displays, verify R1 = +00900, R2 = +00000, and R3 = +00002.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- VERB 25 ENTR  
+00900 ENTR (Test Time in Seconds)  
+00000 ENTR (Test Index Number)  
+00002 ENTR (Test Position Entry)
- 6.2.16.13 On K-148, enter the following sequence:
- VERB 33 ENTR
- 6.2.16.14 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.15 On K-148, enter the following sequence:
- VERB 33 ENTR
- 6.2.16.16 In approximately 90 seconds VERB 06 NOUN 98 shall flash. From the CRT, record R1 and R2.
- 6.2.16.17 On K-148, enter the following sequence:
- VERB 33 ENTR
- 6.2.16.18 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2. Record CRT CDU gimbal angle indications and time.
- 6.2.16.19 On K-148, enter the following sequence:
- VERB 34 ENTR  
VERB 06 NOUN 98 shall flash

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6.2.16.20 On CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00011.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR  
+00900 ENTR (Test Time in Seconds)  
+00000 ENTR (Test Index Number)  
+00011 ENTR (Test Position Entry)

6.2.16.21 On K-148, enter the following sequence:

VERB 33 ENTR

6.2.16.22 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.23 On K-148 enter the following sequence:

VERB 34 ENTR  
VERB 06 NOUN 98 shall flash

6.2.16.24 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00004.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR  
+00900 ENTR (Test Time in Seconds)  
+00000 ENTR (Test Index Number)  
+00004 ENTR (Test Position Entry)

6.2.16.25 On K-148, enter the following sequence:

VERB 33 ENTR

6.2.16.26 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.27 On K-148, enter the following sequence:

VERB 33 ENTR

6.2.16.28 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.

6.2.16.29 On K-148, enter the following sequence:

VERB 33 ENTR



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- 6.2.16.30 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.31 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 33 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.32 From the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00005.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00005  | ENTR (Test Position Entry)  |
- 6.2.16.33 Record Time. On K-148 enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.34 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset. The PROG alarm shall extinguish.
- 6.2.16.35 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, Record R1 and R2.
- 6.2.16.36 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.37 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00006.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2, and R3 are incorrect, enter the following sequence on K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00006  | ENTR (Test Position Entry)  |
- 6.2.16.38 Record Time. On K-148 enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

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- 6.2.16.39 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset. The PROG alarm lamp shall extinguish.
- 6.2.16.40 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.
- 6.2.16.41 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.42 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00007.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00007  | ENTR (Test Position Entry)  |
- 6.2.16.43 On K-148, enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.44 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.45 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.46 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00008.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00008  | ENTR (Test Position Entry)  |
- 6.2.16.47 On K-148, enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.48 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

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- 6.2.16.49 On K-148, enter the following:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.50 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00009.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00009  | ENTR (Test Position Entry)  |
- 6.2.16.51 On K-148, enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.52 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.53 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.54 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00010.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00010  | ENTR (Test Position Entry)  |
- 6.2.16.55 On K-148 enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.56 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.57 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 33 | ENTR                |
| VERB 06 | NOUN 98 shall flash |

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6.2.16.58 On CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00003.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

|         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00003  | ENTR (Test Position Entry)  |

6.2.16.59 On K-148, enter the following sequence:

|         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.60 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.61 On K-148 enter the following sequence:

|         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.62 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2. Row 1 is whole part, Row 2 is fractional part. Units are cm/sec<sup>2</sup>.

6.2.16.63 On K-148, enter the following sequence:

|         |                      |
|---------|----------------------|
| VERB 34 | ENTR                 |
| VERB 06 | NOUN 98 shall flash. |

6.2.16.64 On CRT DSKY displays, verify R1 = +00900, R2 = +00000, and R3 = +00001.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

|         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00001  | ENTR (Test Position Entry)  |

6.2.16.65 On K-148, enter the following sequence:

|         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.66 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

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- 6.2.16.67 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.2.16.68 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.
- 6.2.16.69 On K-148, enter the following sequence:  
VERB 34 ENTR  
VERB 06 NOUN 98 shall flash
- 6.2.16.70 On CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00013.  
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:  
VERB 25 ENTR  
+00900 ENTR (Test Time in Seconds)  
+00000 ENTR (Test Index Number)  
+00013 ENTR (Test Position Entry)
- 6.2.16.71 On K-148, enter the following sequence:  
VERB 33 ENTR
- 6.2.16.72 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.73 Terminate this test by entering the following into K-148:  
VERB 36 ENTR
- 6.2.16.74 On K-148 enter the following sequence:  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.2.16.75 Calculations

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TABLE XXI

| Position No. as<br>Displayed in R3 | Quantity Being Measured                                                |
|------------------------------------|------------------------------------------------------------------------|
| +00001                             | +NBDY + ADOAY<br>+X PIPA G                                             |
| +00002                             | +NBDZ - ADOAZ<br>-X PIPA G<br>-NBDX + ADIAX                            |
| +00003                             | -NBDX - ADOAX<br>+Z PIPA G                                             |
| +00004                             | +NBDY + ADSRAY<br>-Z PIPA G<br>+NBDZ + ADMAZ                           |
| +00005                             | +Y PIPA G                                                              |
| +00006                             | -Y PIPA G                                                              |
| +00007                             | -NBDX + .707 (ADSRAX - ADOAX)                                          |
| +00008                             | -.707 (NBDZ + NBDY)<br>+.5 (ADIAZ - ADIAY)<br>+.5 (ADSRAY + ADSRAZ)    |
| +00009                             | -NBDZ + .707 (ADSRAX - ADOAZ)                                          |
| +00010                             | .707 (NBDY - NBDX)<br>+.5 (ADIAY - ADIAX)<br>+.5 (ADSRAX) + .5 (ADOAY) |
| +00011                             | +NBDX - ADOAX                                                          |
| +00012                             | +NBDY - ADOAY                                                          |
| +00013                             | +NBDZ + ADOAZ                                                          |

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6.2.16.75.1 Measured Values

| <u>Line</u> | <u>Position No.</u> | <u>Parameter</u>                                                   | <u>Recorded Value</u> |
|-------------|---------------------|--------------------------------------------------------------------|-----------------------|
| 1.          | +00001              | +NBDY + ADOAY                                                      | R2                    |
| 2           | +00001              | +X PIPA G                                                          | R1 • R2               |
| 3           | +00002              | +NBDZ - ADOAZ                                                      | R2                    |
| 4           | +00002              | -X PIPA G                                                          | R1 • R2               |
| 5           | +00002              | -NBDX + ADIAX                                                      | R2                    |
| 6           | +00003              | -NBDX - ADOAX                                                      | R2                    |
| 7           | +00003              | +Z PIPA G                                                          | R1 • R2               |
| 8           | +00004              | +NBDY + ADSRAY                                                     | R2                    |
| 9           | +00004              | -Z PIPA G                                                          | R1 • R2               |
| 10          | +00004              | +NBDZ + ADIAZ                                                      | R2                    |
| 11          | +00005              | +Y PIPA G                                                          | R1 • R2               |
| 12          | +00006              | -Y PIPA G                                                          | R1 • R2               |
| 13          | +00007              | -NBDX + .707 (ADSRAX - ADOAX)                                      | R2                    |
| 14          | +00008              | .707 (-NBDZ - NBDY) + .5 (ADIAZ - ADIAX) + .5 (ADSRAY + ADSRAZ)    | R2                    |
| 15          | +00009              | -NBDZ + .707 (ADSRAX - ADOAX)                                      | R2                    |
| 16          | +00010              | .707 (NBDY - NBDX) + .5 (ADIAZ - ADIAX) + .5 (ADSRAX) + .5 (ADOAY) | R2                    |
| 17          | +00011              | +NBDX - ADOAX                                                      | R2                    |
| 18          | +00012              | +NBDY - ADOAY                                                      | R2                    |
| 19          | +00013              | +NBDZ + ADOAZ                                                      | R2                    |

6.2.16.75.2 Y PIPA Data Correction Calculation

6.2.16.75.2.1 From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the X and Z accelerometer  $\Delta V$  counts (addresses 37 and 41, respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) for the period during which the Y PIPA test was being performed in positions 5 and 6 of the IMU Performance test.

6.2.16.75.2.2 Perform the following calculations for position 5.

$$G'_5 = \frac{G_5}{\cos \theta_{y_5}}$$

where:

$G_5$  = Measured acceleration term (line 11)

$G'_5$  = Corrected acceleration term

$$\cos \theta_{y_5} = 1 - \frac{1}{\theta_{y_5}^2} \text{ for small angles}$$

$$\theta_{y_5} = \sqrt{\theta_{x5}^2 + \theta_{z5}^2}$$

and:

$$\theta_{x5} = (\Delta V_{x5} - \Delta V_{x \text{ Bias}}) (S.F._x) / (\Delta T) (\text{local } g)$$

$$\theta_{z5} = (\Delta V_{z5} - \Delta V_{z \text{ Bias}}) (S.F._z) / (\Delta T) (\text{local } g)$$

and:

$$V_{x \text{ Bias}} = (X \text{ PIPA Bias}) (\Delta T) / S.F._x$$

$$V_{z \text{ Bias}} = (Z \text{ PIPA Bias}) (\Delta T) / S.F._z$$

6.2.16.75.2.3 Perform the following calculations for position 6.

$$G'_6 = \frac{G_6}{\cos \theta_{y_6}}$$

where:

$G_6$  = Measured acceleration term (line 12)

$G'_6$  = Corrected acceleration term

$$\cos \theta_{y_6} = 1 - \frac{1}{\theta_{y_6}^2} \text{ for small angles}$$



6.2.16.17.2.3  
(continued)

$$\sigma_{y_6} = \sqrt{\sigma_{x_6}^2 + \sigma_{z_6}^2}$$

and:

$$\sigma_{x_6} = (\Delta V_{x_6} - \Delta V_x \text{ Bias}) (S.F._x) / (\Delta T) \text{ (local g)}$$

$$\sigma_{z_6} = (\Delta V_{z_6} - \Delta V_z \text{ Bias}) (S.F._z) / (\Delta T) \text{ (local g)}$$

and:

$$V_x \text{ Bias} = (X \text{ PIPA Bias}) (\Delta T) / S.F._x$$

$$V_z \text{ Bias} = (Z \text{ PIPA Bias}) (\Delta T) / S.F._z$$

6.2.16.75.2.4 Compute the PIPA Scale Factor error in parts per million and record in Table X<sub>1</sub>.

$$a. \text{ PIPA S.F. Error} = \left[ \frac{2 \text{ local g}}{+PIPA G - (-PIPA G)} - 1.000000 \right] 10^6$$

$$b. \text{ X PIPA S.F. Error} = \left[ \frac{2 \text{ local g}}{\text{line 2} - \text{line 4}} - 1.000000 \right] 10^6$$

$$c. \text{ Y PIPA S.F. Error} = \left[ \frac{2 \text{ local g}}{G'_5 - G'_6} - 1.000000 \right] 10^6$$

$$d. \text{ Z PIPA S.F. Error} = \left[ \frac{2 \text{ local g}}{\text{line 7} - \text{line 9}} - 1.000000 \right] 10^6$$

The PIPA S.F. Error shall not exceed ±1900 PPM

TABLE XXII  
Local Gravity Values

| Location | Local Gravity (cm/sec <sup>2</sup> ) |
|----------|--------------------------------------|
| NAA      | 979.56                               |
| MSC      | 979.29                               |
| KSC      | 979.24                               |

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6.2.16.75.2.5 Compute the PIPA Bias in cm/sec<sup>2</sup> and record in Table X<sub>1</sub>.

$$a. \text{ PIPA Bias} = \frac{+ \text{PIPA G} + (- \text{PIPA G})}{2}$$

$$b. \text{ X PIPA Bias} = \frac{\text{line 2} + \text{line 4}}{2}$$

$$c. \text{ Y PIPA Bias} = \frac{G'_5 + G'_6}{2}$$

$$d. \text{ Z PIPA Bias} = \frac{\text{line 7} - \text{line 9}}{2}$$

The PIPA Bias shall not exceed  $\pm 2.28$  cm/sec<sup>2</sup>.

6.2.16.75.2.6 Calculate NBD, ADOA, ADSRA, and ADIA.

$$a. \text{ NBDX} = \frac{-\text{line 6} + \text{line 17}}{2} =$$

$$\text{NBDY} = \frac{\text{line 1} + \text{line 18}}{2} =$$

$$\text{NBDZ} = \frac{\text{line 3} + \text{line 19}}{2} =$$

NBD shall not exceed  $\pm 15$  meru. Record values in Table X<sub>1</sub>.

$$b. \text{ ADOAX} = \frac{-\text{line 6} - \text{line 17}}{2} =$$

$$\text{ADOAY} = \frac{\text{line 1} - \text{line 18}}{2} =$$

$$\text{ADOAZ} = \frac{-\text{line 3} + \text{line 19}}{2} =$$

$$c. \text{ ADSRAX} = \frac{\text{line 13} + \text{NBDX}}{.707} + \text{ADOAX} =$$

$$\text{ADSRAY} = \text{line 8} - \text{NBDY} =$$

$$\text{ADSRZ} = \frac{\text{line 15} + \text{NBDZ}}{.707} + \text{ADOAZ} =$$

ADSR shall not exceed  $\pm 40$  meru/g. Record value in Table X<sub>1</sub>.

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6.2.16.75.2.6 d. ADIAX = line 5 + NBDX =  
(continued)

$$ADIAV = \frac{\text{line 16} - .707(\text{NBDY} - \text{NBDX})}{.5} - \text{ADSRAX} + \text{ADIAX} - \text{ADOAY}$$

$$\text{ADIAZ} = \text{line 10} - \text{NBDZ} =$$

ADIA shall not exceed  $\pm 100$  meru/g. Record value in Table  $X_1$

6.2.16.75.2.7 Perform the following calculations for each term in Table  $X_1$ , and record the results in Table D.

$$D_1 = |X_{i-1} - X_i|$$

$$D_2 = |X_{i-1} - X_i| + |X_{i-2} - X_{i-1}|$$

$$D_3 = |X_{i-3} - X_{i-2}| + |X_{i-2} - X_{i-1}| + |X_{i-1} - X_i|$$

$X_i$  = data point just obtained

$X_{i-1}$  = last historical data point

$X_{i-2}$  = second last historical data point

$X_{i-3}$  = third last historical data point

NOTE:  $D_1$  calculations begin with the first data point after ISS pre-Vib;  
 $D_2$  calculations begin with the second data point after ISS Pre-Vib;  
 $D_3$  calculations begin with the third data point after Pre-Vib.

6.2.16.75.3 Obtain data from last historical IRIG and PIPA test and complete Table X<sub>1-1</sub>.

TABLE X<sub>1-1</sub>

| PARAMETER          | UNITS               | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDX               | meru                |                |
| NBDY               | meru                |                |
| NBDZ               | meru                |                |
| ADSRAX             | meru/g              |                |
| ADSRAY             | meru/g              |                |
| ADSRZ              | meru/g              |                |
| ADIAX              | meru/g              |                |
| ADIAZ              | meru/g              |                |
| X PIPA S. F. Error | PPM                 |                |
| Y PIPA S. F. Error | PPM                 |                |
| Z PIPA S. F. Error | PPM                 |                |
| X PIPA Bias        | cm/sec <sup>2</sup> |                |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                |

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6.2.16.75.4 Obtain data from the second last historical IRIG and PIPA test and complete Table X<sub>1-2</sub>.

TABLE X<sub>1-2</sub>

| PARAMETER          | UNITS               | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDX               | meru                |                |
| NBDY               | meru                |                |
| NBDZ               | meru                |                |
| ADSRAX             | meru/g              |                |
| ADSRAY             | meru/g              |                |
| ADSRZ              | meru/g              |                |
| ADLAX              | meru/g              |                |
| ADLAY              | meru/g              |                |
| ADLAZ              | meru/g              |                |
| X PIPA S. F. Error | PPM                 |                |
| Y PIPA S. F. Error | PPM                 |                |
| Z PIPA S. F. Error | PPM                 |                |
| X PIPA Bias        | cm/sec <sup>2</sup> |                |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                |

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6.2.16.75.5 Obtain data from the third last historical IRIG and PIPA test and complete Table X<sub>1-3</sub>.

TABLE X<sub>1-3</sub>.

| PARAMETER          | UNITS               | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDX               | meru                |                |
| NBDY               | meru                |                |
| NBDZ               | meru                |                |
| ADSRAX             | meru/g              |                |
| ADSRAY             | meru/g              |                |
| ADSRZ              | meru/g              |                |
| ADLAX              | meru/g              |                |
| ADLAY              | meru/g              |                |
| ADLAZ              | meru/g              |                |
| X PIPA S. F. Error | PPM                 |                |
| Y PIPA S. F. Error | PPM                 |                |
| Z PIPA S. F. Error | PPM                 |                |
| X PIPA Bias        | cm/sec <sup>2</sup> |                |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                |

TABLE X<sub>1</sub>

| PARAMETER          | UNITS               | CALCULATED VALUE |
|--------------------|---------------------|------------------|
| NBDX               | m/sec               |                  |
| NBDY               | m/sec               |                  |
| NBDZ               | m/sec               |                  |
| ADSRAX             | m/sec/g             |                  |
| ADSRAY             | m/sec/g             |                  |
| ADSRZ              | m/sec/g             |                  |
| ADLAX              | m/sec/g             |                  |
| ADLAY              | m/sec/g             |                  |
| ADLAZ              | m/sec/g             |                  |
| X PIPA S. F. Error | PPM                 |                  |
| Y PIPA S. F. Error | PPM                 |                  |
| Z PIPA S. F. Error | PPM                 |                  |
| X PIPA Bias        | cm/sec <sup>2</sup> |                  |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                  |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                  |

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TABLE D

| PARAMETER          | UNITS               | D <sub>1</sub> | MAX | D <sub>2</sub> | MAX | D <sub>3</sub> | MAX |
|--------------------|---------------------|----------------|-----|----------------|-----|----------------|-----|
| NBDX               | meru                |                | 6   |                | 9   |                | 11  |
| NBDY               | meru                |                | 6   |                | 9   |                | 11  |
| NBDZ               | meru                |                | 6   |                | 9   |                | 11  |
| ADSRAX             | meru/g              |                | 14  |                | 21  |                | 25  |
| ADSRAY             | meru/g              |                | 14  |                | 21  |                | 25  |
| ADSRAZ             | meru/g              |                | 14  |                | 21  |                | 25  |
| ADLAX              | meru/g              |                | 17  |                | 33  |                | 40  |
| ADLAY              | meru/g              |                | 17  |                | 33  |                | 40  |
| ADLAZ              | meru/g              |                | 17  |                | 33  |                | 40  |
| X PIPA S. F. Error | PPM                 |                | 400 |                | 500 |                | 600 |
| Y PIPA S. F. Error | PPM                 |                | 400 |                | 500 |                | 600 |
| Z PIPA S. F. Error | PPM                 |                | 400 |                | 500 |                | 600 |
| X PIPA Bias        | cm/sec <sup>2</sup> |                | 0.5 |                | 0.7 |                | 0.9 |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                | 0.5 |                | 0.7 |                | 0.9 |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                | 0.5 |                | 0.7 |                | 0.9 |

6.2.16.75.6 Failure to meet the above criteria shall result in retest according to 5.4.2.



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- 6.2.17 SXT-NB-Fine Alignment Test
- 6.2.17.1 Deleted
- 6.2.17.2 The G&N shall have had OPERATE power applied for a minimum of 1 hour.
- 6.2.17.3 Set the G/N POWER-OPTICS switch to OPTICS. Verify that +28 VDC OPTICS OPERATE BUS (CG 1630) is +28.0±3.0 VDC. Verify that the OPTX 28V 800 cps 1% 0° ph (CG 1211) and OPTX 28V 800 cps 5% -90° ph (CG 1212) are not flashing on the CRT.
- 6.2.17.4 Deleted.
- 6.2.17.5 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
On the G&N Indicator Control Panel set the following switches to the position indicated.
- a. OPTICS TEL TRUN to SLAVE to SXT
  - b. OPTICS COUPLING to DIRECT
  - c. OPTICS SPEED to LO
  - d. OPTICS MODE to MAN
  - e. OPTICS ZERO to ZERO
- 6.2.17.6 Deleted.
- 6.2.17.7 Deleted
- 6.2.17.8 Initiate the test by entering the following sequence into the LEB DSKY.
- a. VERB 92, ENTER
  - b. 00003, ENTER
- 6.2.17.9 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data is display in R1 and R2 on the DSKY.
- a. R1 = +13500
  - b. R2 = +xx.xxx (Site Latitude from Table I)

TABLE I

| <u>SITE</u> | <u>LATITUDE</u> |
|-------------|-----------------|
| NAA         | +33.921         |
| MSC         | +29.556         |
| KSC MSO     | +28.523         |
| KSC VAB     | +28.585         |
| KSC PAD 39  | +28.607         |

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- 6.2.17.10 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If the value displayed is other than +13500 in R1 and the correct Site Latitude in R2, correct the data by entering the following sequence into the DSKY.
- VERB 21, ENTER
  - +13500, ENTER
  - VERB 22, ENTER
  - +xx.xxx, ENTER (+xx.xxx = Site Latitude from Table I)
  - VERB 33, ENTER
- 6.2.7.11 Observe VERB 25 NOUN 97 flashing on the DSKY. Enter the following sequence into the DSKY.
- +00001, ENTER (Position Number)
  - +00000, ENTER
  - +00001, ENTER
- 6.2.17.12 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- R1 = +xxx.xx (Y<sub>NB</sub> Azimuth)
  - R2 = +xx.xxx (Y<sub>NB</sub> Elevation)
  - R3 = 00001
- 6.2.17.13 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct Y<sub>NB</sub> azimuth and elevation, correct the data by entering the following sequence into the DSKY.
- VERB 24, ENTER
  - +xxx.xxx±002.00 degrees, ENTER (Y<sub>NB</sub> Azimuth)
  - +xx.xxx±02.000 degrees, ENTER (Y<sub>NB</sub> Elevation)
  - VERB 33, ENTER
- 6.2.17.14 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- R1 = +xxx.xx (Z<sub>NB</sub> Azimuth)
  - R2 = +xx.xxx (Z<sub>NB</sub> Elevation)
  - R3 = 00002
- 6.2.17.15 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct Z<sub>NB</sub> azimuth and elevation, correct the data by entering the following sequence into the DSKY.
- VERB 24, ENTER
  - +xxx.xxx±002.00 degrees, ENTER (Z<sub>NB</sub> Azimuth)
  - +xx.xxx±02.000 degrees, ENTER (Z<sub>NB</sub> Elevation)
  - VERB 33, ENTER

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- 6.2.17.16 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- a. R1 = +xxx.xx (Target 1 Azimuth)
  - b. R2 = +xx.xxx (Target 1 Elevation)
  - c. R3 = 00001
- 6.2.17.17 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct azimuth and elevation for Target 1, correct the data by entering the following sequence into the DSKY.
- a. VERB 24, ENTER
  - b. +xxx.xxx000.10 degrees, ENTER (Target 1 Azimuth)
  - c. xxx.xxx00.010 degrees, ENTER (Target 1 Elevation)
  - d. VERB 33, ENTER
- 6.2.17.18 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- a. R1 = +xxx.xx (Target 2 Azimuth)
  - b. R2 = xxx.xxx (Target 2 Elevation)
  - c. R3 = 00002
- 6.2.17.19 If the data displayed is correct proceed to 6.2.17.22. If R1 and R2 do not contain the correct azimuth and elevation for Target 2, correct the data by entering the following sequence into the DSKY.
- a. VERB 24, ENTER
  - b. +xxx.xxx000.10 degrees, ENTER (Target 2 Azimuth)
  - c. xxx.xxx00.010 degrees, ENTER (Target 2 Elevation)
- 6.2.17.20 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to OFF. Enter VERB 33, ENTER into the DSKY.
- 6.2.17.21 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00001, on the DSKY set the OPTICS MODE switch on the G&N Indicator Control Panel to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.
- 6.2.17.22 Using the Optics Hand Controller, align the SXT StLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.

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- 6.2.17.23 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement of the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.24 Using the Optics Hand Controller, align the SXT StLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- NOTE: The following two MARKS must be performed as quickly as possible. In no case shall the time between the first and second MARK exceed two minutes.
- 6.2.17.25 After 20 seconds observe the DSKY for VERB 51 and NOUN 70 flashing and R1 = 00001. Set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.
- 6.2.17.26 Using the Optics Hand Controller, align the SXT StLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.27 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement to the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.28 Using the Optics Hand Controller, align the SXT StLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.29 In approximately 7 minutes VERB 06 NOUN 98 shall flash on the DSKY and the test results shall be displayed. R1 and R2 on the DSKY shall display the misalignment of one of the horizontal PIPA's in arc seconds (R1 = whole, R2 = fractional). Record R1 and R2. (See Table III for PIPA displayed.)
- 6.2.17.30 Enter VERB 33 ENTER into the DSKY. When VERB 06 NOUN 98 flashes R1 and R2 on the DSKY shall display the misalignment of the second horizontal PIPA in arc seconds (R1 whole, R2 fractional). (See Table III for PIPA displayed). Record R1 and R2.

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- 6.2.17.31 Enter VERB 34 ENTER into the DSKY to terminate the test. Wait 5 seconds.
- 6.2.17.32 Repeat steps 6.2.17.4 and 6.2.17.6 through 6.2.17.31 substituting No. 00002 in 6.2.17.11.a.
- 6.2.17.33 Enter the following sequence into the DSKY:
- VERB 36, ENTER
  - VERB 41 NOUN 20, ENTER
  - +00000, ENTER
  - +00000, ENTER
  - +00000, ENTER
- 6.2.17.34 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.

Table III. DISPLAY CONDITIONS AT TEST COMPLETION

| Position | SM Orientation  |                 |                 | Horizontal Misalignment Component |                 |
|----------|-----------------|-----------------|-----------------|-----------------------------------|-----------------|
|          | X <sub>SM</sub> | Y <sub>SM</sub> | Z <sub>SM</sub> | 6.2.17.29                         | 6.2.17.30       |
| 1.       | UP              | SW              | SE              | Y <sub>SM</sub>                   | Z <sub>SM</sub> |
| 2.       | SE              | SW              | DN              | X <sub>SM</sub>                   | Y <sub>SM</sub> |
| 3.*      | SE              | UP              | SW              | X <sub>SM</sub>                   | Z <sub>SM</sub> |

\* Position 3 is not run in the Spacecraft because of GIMBAL LOCK considerations.

6.2.17.35 Calculations

- 6.2.17.35.1
- $Y_{SM} \text{ misalignment} = ( ) \frac{R1.R2}{}$
  - $Z_{SM} \text{ misalignment} = ( ) \frac{R1.R2}{}$
  - $X_{SM} \text{ misalignment} = ( ) \frac{R1.R2}{}$
  - $Y_{SM} \text{ misalignment} = ( ) \frac{R1.R2}{}$

6.2.17.35.2 Enter the latest values from 6.2.16 IMU Performance Test.

- X PIPA bias =                      cm/sec<sup>2</sup>
- Y PIPA bias =                      cm/sec<sup>2</sup>
- Z PIPA bias =                      cm/sec<sup>2</sup>
- $\theta_x = 210$  (X PIPA bias) =                      arc sec.
- $\theta_y = 210$  (Y PIPA bias) =                      arc sec.
- $\theta_z = 210$  (Z PIPA bias) =                      arc sec.

- 6.2.17.35.3 a.  $Y_{SM}$  misalignment (Bias corrected) = 6.2.17.35.1a -  $\theta_y$  = \_\_\_\_\_ arc sec.  
b.  $Z_{SM}$  misalignment (Bias corrected) = 6.2.17.35.1b -  $\theta_z$  = \_\_\_\_\_ arc sec.  
c.  $X_{SM}$  misalignment (Bias corrected) = 6.2.16.35.1c -  $\theta_x$  = \_\_\_\_\_ arc sec.  
d.  $Y_{SM}$  misalignment (Bias corrected) = 6.2.17.35.1d -  $\theta_y$  = \_\_\_\_\_ arc sec.

The SM misalignment in each orientation, excluding PIPA bias, shall not exceed  $\pm 180$  arc seconds.

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6.2.18 Gyrocompassing Test

6.2.18.1 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify that +28 vdc OPTICS OPERATE BUS (CG 1530) is +28.0±3.0 vdc. Verify that the OPTX 28V 800 cps 1% 0° (CG 1211) and OPTX 28V 800 cps 5%-90° (CG 1212) are not flashing in the CRT.

6.2.18.2 Load the Inertial Instrument Calibration Data into the CMC using the following sequence:

|                      |         |      |
|----------------------|---------|------|
| VERB 21              | NOUN 01 | ENTR |
| 01716                |         | ENTR |
| XXXXX (X PIPA BIAS)  |         | ENTR |
|                      |         | ENTR |
| 01717                |         | ENTR |
| XXXXX (X PIPA S. F.) |         | ENTR |
|                      |         | ENTR |
| 01720                |         | ENTR |
| XXXXX (Y PIPA BIAS)  |         | ENTR |
|                      |         | ENTR |
| 01721                |         | ENTR |
| XXXXX (Y PIPA S. F.) |         | ENTR |
|                      |         | ENTR |
| 01722                |         | ENTR |
| XXXXX (Z PIPA BIAS)  |         | ENTR |
|                      |         | ENTR |
| 01723                |         | ENTR |
| XXXXX (Z PIPA S. F.) |         | ENTR |
|                      |         | ENTR |
| 01724                |         | ENTR |
| XXXXX (NBDX)         |         | ENTR |
|                      |         | ENTR |
| 01725                |         | ENTR |
| XXXXX (NBDY)         |         | ENTR |
|                      |         | ENTR |
| 01726                |         | ENTR |
| XXXXX (NBDZ)         |         | ENTR |
|                      |         | ENTR |
| 01727                |         | ENTR |
| XXXXX (ADLAX)        |         | ENTR |
|                      |         | ENTR |
| 01730                |         | ENTR |
| XXXXX (ADLAY)        |         | ENTR |
|                      |         | ENTR |
| 01731                |         | ENTR |
| XXXXX (ADLAZ)        |         | ENTR |
|                      |         | ENTR |
| 01732                |         | ENTR |
| XXXXX (ADSRAX)       |         | ENTR |

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6.2.18.2  
(Continued)

|                |      |
|----------------|------|
| 01733          | ENTR |
| XXXXX (ADSRAY) | ENTR |
|                | ENTR |
| 01734          | ENTR |
| XXXXX (ADGRAZ) | ENTR |

6.2.18.3 Enter NB Azimuth and Site Latitude (from Table III) and Launch Azimuth into the CMC using the following sequence:

|         |         |                                   |
|---------|---------|-----------------------------------|
| VERB 21 | NOUN 01 | ENTR                              |
| 2506    |         | ENTR (NB Azimuth)                 |
| XXXXX   |         | ENTR (fraction of a Rev Hi order) |
|         |         | ENTR                              |
| 2507    |         | ENTR (NB Azimuth)                 |
| XXXXX   |         | ENTR (fraction of a Rev Lo order) |
|         |         | ENTR                              |
| 2510    |         | ENTR (Site Latitude)              |
| XXXXX   |         | ENTR (fraction of a Rev Hi order) |
|         |         | ENTR                              |
| 2511    |         | ENTR (Site Latitude)              |
| XXXXX   |         | ENTR (fraction of a Rev Lo order) |
|         |         | ENTR                              |
| 2755    |         | ENTR (Launch Azimuth)             |
| XXXXX   |         | ENTR (fraction of a Rev Hi order) |
|         |         | ENTR                              |
| 2756    |         | ENTR (Launch Azimuth)             |
| XXXXX   |         | ENTR (fraction of a Rev Lo order) |

TABLE III

| Location   | Latitude (Fraction of a Rev)<br>Hi Order | Low Order |
|------------|------------------------------------------|-----------|
| NAA        | 03007                                    | 36671     |
| MSC        | 02423                                    | 23341     |
| KSC MSO    | 02423                                    | 04033     |
| KSC VAB    | 02424                                    | 36151     |
| KSC PAD 39 | 02425                                    | 37327     |

6.2.18.4 Enter the following into the CMC:

VERB 37 ENTER, 01 ENTER



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- 6.2.18.5 When PROG display changes to 02, record time as  $T_0$ .
- 6.2.18.6 Gyro Compassing Accuracy
- 6.2.18.6.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. After 120 minutes from  $T_0$ , set the OPTICS ZERO switch on the G&N Indicator to ZERO.
- 6.2.18.6.2 Enter VERB 65, ENTER into DSKY.  
Observe the PROGRAM display on the DSKY change to 03.
- 6.2.18.6.3 When VERB 06 NOUN 41 flashes on the DSKY, insure R1 and R2 display Target 1 azimuth and elevation.
- a. R1 = +XXX.XX (Target 1 azimuth)
  - b. R2 = +XX.XXX (Target 1 elevation)
  - c. R3 = 00001
- 6.2.18.6.4 Verify the data appearing in R1 and R2 and if correct, proceed. If not correct, perform the following sequence:
- a. VERB 24, ENTER
  - b. +XXX.XX, ENTER (Target 1 azimuth)
  - c. -XX.XXX, ENTER (Target 1 elevation)
- 6.2.18.6.5 After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY.
- 6.2.18.6.6 When VERB 06 NOUN 41 flashes on the DSKY, insure that R1 and R2 display Target 2 azimuth and elevation.
- a. R1 = XXX.XX (Target 2 azimuth)
  - b. R2 = XX.XXX (Target 2 elevation)
  - c. R3 = 00002.
- 6.2.18.6.7 Verify the data appearing in R1 and R2 and if correct, perform the following sequence:
- a. VERB 24, ENTER
  - b. +XXX.XX, ENTER (Target 2 azimuth)
  - c. -XX.XXX, ENTER (Target 2 elevation)

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- 6.2.18.6.8 After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY.
- 6.2.18.6.9 Using the Optics Hand Controller, align the SXT StLOS to Target 1 and press MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied with MARK, press MARK REJECT pushbutton and repeat this step.
- 6.2.18.6.10 Set the OPTICS SPEED switch to HI. Using the Optics Hand Controller, drive the SXT StLOS to the approximate position of Target 2.
- 6.2.18.6.11 Set the OPTICS SPEED switch to LO. Using the Optics Hand Controller, align the SXT StLOS to Target 2 and press the MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied, press the MARK REJECT pushbutton and repeat this step.
- 6.2.18.6.12 On the DSKY observe the following data displayed:
- a. VERB 06 NOUN 93
  - b. R1 =  $\pm XX.XXX$  (X gyro elevation error)
  - c. R2 =  $\pm XX.XXX$  (Y gyro elevation error)
  - d. R3 =  $\pm XX.XXX$  (Z gyro azimuth error)
- Record R1, R2 and R3. The X and Y gyro elevation error shall be  $0.00 \pm 0.55$  degrees, and the Z gyro azimuth error shall be  $0.00 \pm 0.3$  degrees.
- 6.2.18.6.13 CAUTION: See Paragraph 5.1.2.11 before proceeding.
- Enter VERB 34 ENTER into the DSKY. Observe the PROGRAM display change to 02. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Immediately repeat Steps 6.2.18.6.2 through 6.2.18.6.13 twice.
- 6.2.18.6.14 Repeat Steps 6.2.18.6.2 through 6.2.18.6.13 at 150, 180 and 210 minutes from  $T_0$ .
- 6.2.18.6.15 Enter VERB 36 into the DSKY. Press the ENTER pushbutton.
- 6.2.18.6.16 Enter VERB 41 NOUN 20 into the DSKY. Press the ENTER pushbutton. Enter +00000 into the DSKY three times. Press the ENTER pushbutton after each entry. Set the G&N POWER OPTICS switch on the LEB Lighting Control Panel to OFF.

**6.2.15.7 Gyrocompassing Stability**

**6.2.15.7.1** Calculate the average of the first three X and Y gyro elevation errors and the first three Z gyro azimuth errors.

**6.2.15.7.2** The last three X and Y gyro elevation errors shall not deviate from the baseline X and Y gyro elevation errors determined above by more than  $\pm 0.15$  degrees.

**6.2.15.7.3** The last three Z gyro azimuth errors shall not deviate from the baseline Z gyro azimuth error determined above by more than  $\pm 0.06$  degrees.

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6.2.19 CMC Voltage Margin Test

6.2.19.1 Verify that the G&N IMU HTR MNA & MNB circuit breakers are engaged, Computer NMA & NMB breakers are engaged, IMU MNA & MNB circuit breakers are not engaged, and the G&N Power - IMU switch on the LEB Lighting Control Panel is in the OFF position.

6.2.19.2 On the PSA Adapter Module set the INHIBIT VOLTAGE FAIL switch to ON.

**Caution:** During the performance of this test the +4 VDC CMC Power Supply shall not be operated at less than +2.5 VDC or greater than 5.2 VDC (CG 1030). The +14 VDC CMC Power Supply shall not be operated at less than +6.5 VDC or greater than +17.0 VDC (CG 1020). Rotate the LEB LTS NUMERICS SEL to approximately center position. Decrease to absolute minimum discernable lighting.

**Note:** The flashing indication of the CMC Power Supplies on CRT may be disregarded for this test. The charts in Table I may be used to determine approximate values for the "XX.X" values of C-106 voltage dial settings corresponding to various power supply voltages.

6.2.19.3 Into R154 insert 0001. Verify and execute.

6.2.19.3.1 Into R153 insert 1100. Verify and execute.

6.2.19.4 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.

6.2.19.5 Into C156 insert -050001234. Verify and execute. Verify on the CRT that GV0106 is between -4.0 and -6.0 VDC.

6.2.19.6 Into R154 insert 0111. Verify and execute.

6.2.19.7 Observe CG 1020, +14 VDC CMC Power Supply and CG 1030, +4 VDC CMC Power Supply, on the CRT. Repeat 6.2.19.3 through 6.2.19.6 adjusting each C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC and CG 1030 is +3.40 (+0.03 - 0.00) VDC.

6.2.19.8 Initiate CMC Self Check by inserting the following into K148:

- a. ERROR RESET
  - b. VERB 21 NOUN 27, ENTER
  - c. 77777, ENTER
- Wait 200 seconds

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- 6.2.19.9 Insure that the DSKY RESTART lamp and Program Alarm lamp does not light.
- 6.2.19.9.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.10 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify the RESTART lamp on the DSKY is lighted. Disregard other DSKY indications. If RESTART does not light, repeat 6.2.19.9. Verify CMC Warning masters alarm are lighted.
- 6.2.19.11 Set the INHIBIT VOLTAGE FAIL switch to ON. Insert the following into K148:
  - a. ERROR RESET
  - b. VERB 21 NOUN 27, ENTER
  - c. 77777, ENTER
- 6.2.19.12 Into R154 insert 00001. Verify and execute.
- 6.2.19.13 Into C156 insert +108001244. Verify and execute. Verify on the CRT that GV0116 is between +9.8 and +11.8 VDC.
- 6.2.19.14 Into R154 insert 0111. Verify and execute.
- 6.2.19.15 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.12 through 6.2.19.14 adjusting the C-Start entry until CG 1020 is 16.4 (+0.0, -0.1) VDC.
- 6.2.19.16 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.16.1 Into R154 insert 0011. Verify and execute.
- 6.2.19.17 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted.
- 6.2.19.18 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to ON. Into K148 insert:
  - a. ERROR RESET
  - b. VERB 21 NOUN 27, ENTER
  - c. 77777, ENTER
- 6.2.19.19 Into R154 insert 0001. Verify and execute.

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- 6.2.19.20 Into C156 enter +092001234. Verify and execute. Verify on the CRT that GV0106 is between +8.2 and +10.2 VDC.
- 6.2.19.21 Into R156 insert 0111. Verify and execute.
- 6.2.19.22 Observe CG 1000, +4 VDC CMC Power Supply on the CRT. Repeat 6.2.19.19 through 6.2.19.21 adjusting the C-Start entry until CG 1030 is +4.60 (+0.00, -0.03) VDC.
- 6.2.19.23 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.23.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.24 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Verify CMC Warning master alarms are lighted.
- 6.2.19.25 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to ON. Into K148 insert:
- a. ERROR RESET
  - b. VERB 21 NOUN 27, ENTER
  - c. 77777, ENTER
- 6.2.19.26 Into R154 insert 0001. Verify and execute.
- 6.2.19.27 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.28 Into R154 insert 0111. Verify and execute.
- 6.2.19.29 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.26 through 6.2.19.28 adjusting the C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC.
- 6.2.19.30 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.30.1 Into R154 insert 0011. Verify and execute.

- 6.2.19.31 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted.
- 6.2.19.32 Into R154 insert 0000. Verify and execute.
- 6.2.19.33 Terminate CMC Self-Check by inserting into K148.
- a. ERROR RESET
  - b. VERB 21, NOUN 27, ENTER
  - c. 00000, ENTER
- 6.2.19.34 Ensure that CG 1020, +14 VDC CMC Power Supply indication, is  $+14.0 \pm 0.4$  and that CG 1030, +4 VDC CMC Power Supply indication is  $+4.00 \pm 0.20$  VDC on the CRT.

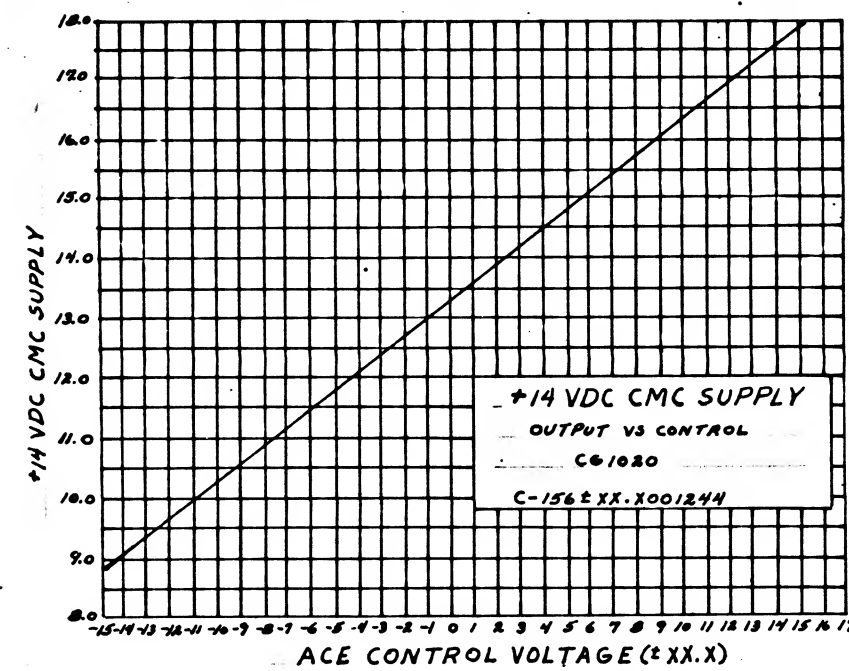
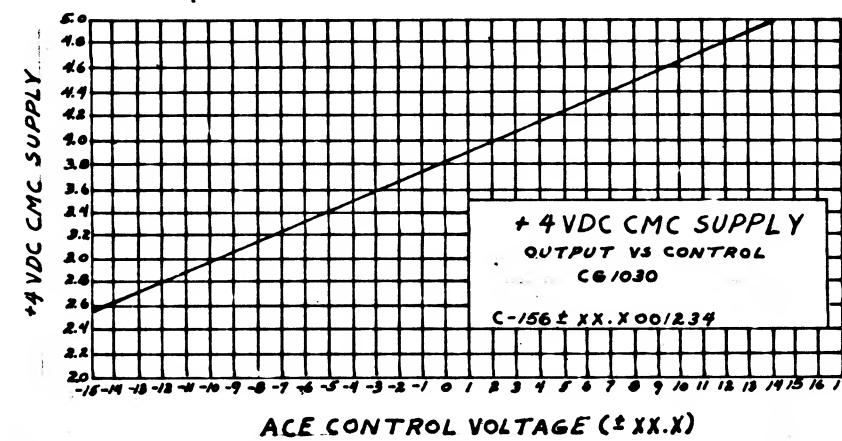


TABLE I



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- 6.2.20 Spacecraft Control and Displays Test.
- 6.2.20.1 Proceed with this test if the Operate Power on Test of 6.2.3 and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.3 before proceeding.
- 6.2.20.2 FDI Attitude Error.
- 6.2.20.2.1 Insert in KI48
- a. V92 ENTER
  - b. 00013 ENTER
- 6.2.20.2.2 Observe on the CRT PROG 07. In approximately 5 sec observe NO ATT ON. In approximately 20 sec observe V06 NO1 flashing and R1, R2 and R3 approximately 00000.
- 6.2.20.2.3 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.4 Observe on CRT
- a. V06 N 01 Flashing
  - b. R1 +00385
  - c. R2 -00385
  - d. R3 +00385
  - e. NO ATT OFF
- 6.2.20.2.5 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +5.06±0.50V rms
  - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -5.06±0.50V rms
  - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +5.06±0.50V rms
- 6.2.20.2.6 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.7 Observe on CRT
- a. V06 NO1 Flashing
  - b. R1 +00384
  - c. R2 -00384
  - d. R3 +00384

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- 6.2.20.2.8 Record CRT indications.
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +5.06±0.50V rms
  - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -5.06±0.50V rms
  - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +5.06±0.50V rms
- 6.2.20.2.9 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.10 Observe on CRT
- a. V06 N01 Flashing
  - b. R1 +00160
  - c. R2 -00160
  - d. R3 +00160
- 6.2.20.2.11 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +2.11±0.21V rms
  - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -2.11±0.21V rms
  - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +2.11±0.21V rms
- 6.2.20.2.12 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.13 Observe on CRT
- a. V06 N01 Flashing
  - b. R1 +00135
  - c. R2 -00135
  - d. R3 +00135
- 6.2.20.2.14 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +1.78±0.18V rms
  - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -1.78±0.18V rms
  - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +1.78±0.18V rms
- 6.2.20.2.15 Insert in KI48
- a. VERB 33, ENTER

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6.2.20.2.16 Observe on CRT.

a. V06 N01 Flashing  
b. R1 +00090  
c. R2 -00090  
d. R3 +00090

6.2.20.2.17 Record CRT indications.

a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +1.19±0.12V rms  
b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -1.19±0.12V rms  
c. CG 2249 YAW ATT ERROR - CDU DAC OUT +1.19±0.12V rms

6.2.20.2.18 Insert in K148.

a. VERB 33, ENTER

6.2.20.2.19 Observe on CRT.

a. V06 N01 Flashing  
b. R1 +00000  
c. R2 +00000  
d. R3 -00090

6.2.20.2.20 Record CRT indications.

a. CG 2279 ROLL ATT ERROR - CDU DAC OUT 0.00±0.06V rms  
b. CG 2219 PITCH ATT ERROR - CDU DAC OUT 0.00±0.06V rms  
c. CG 2249 YAW ATT ERROR - CDU DAC OUT -1.19±0.12V rms

6.2.20.2.21 Insert in K148.

a. VERB 33, ENTER

6.2.20.2.22 Observe on CRT.

a. V06 N01 Flashing  
b. R1 -00090  
c. R2 +00090  
d. R3 -00135

6.2.20.2.23 Record CRT indications

a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -1.19±0.12V rms  
b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +1.19±0.12V rms  
c. CG 2249 YAW ATT ERROR - CDU DAC OUT -1.79±0.18V rms

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6.2.20.2.24 Insert in K148

a. VERB 33, ENTER

6.2.20.2.25 Observe on CRT

|        |     |          |
|--------|-----|----------|
| a. V06 | N01 | Flashing |
| b. R1  |     | -00135   |
| c. R2  |     | +00135   |
| d. R3  |     | -00160   |

6.2.20.2.26 Record CRT indications

|            |                               |                 |
|------------|-------------------------------|-----------------|
| a. CG 2279 | ROLL ATT ERROR - CDU DAC OUT  | -1.78±0.18V rms |
| b. CG 2219 | PITCH ATT ERROR - CDU DAC OUT | +1.78±0.18V rms |
| c. CG 2249 | YAW ATT ERROR - CDU DAC OUT   | -2.11±0.21V rms |

6.2.20.2.27 Insert in K148

a. VERB 33, ENTER

6.2.20.2.28 Observe on CRT

|        |     |          |
|--------|-----|----------|
| a. V06 | N01 | Flashing |
| b. R1  |     | -00160   |
| c. R2  |     | +00160   |
| d. R3  |     | -00384   |

6.2.20.2.29 Record CRT indications

|            |                               |                 |
|------------|-------------------------------|-----------------|
| a. CG 2279 | ROLL ATT ERROR - CDU DAC OUT  | -2.11±0.21V rms |
| b. CG 2219 | PITCH ATT ERROR - CDU DAC OUT | +2.11±0.21V rms |
| c. CG 2249 | YAW ATT ERROR - CDU DAC OUT   | -5.06±0.50V rms |

6.2.20.2.30 Insert K148

a. VERB 33, ENTER

6.2.20.2.31 Observe on CRT

|        |     |          |
|--------|-----|----------|
| a. V06 | N01 | Flashing |
| b. R1  |     | -00384   |
| c. R2  |     | +00384   |
| d. R3  |     | -00385   |

6.2.20.2.32 Record CRT indications.

- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -5.06±0.50V rms
- b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +5.06±0.50V rms
- c. CG 2249 YAW ATT ERROR - CDU DAC OUT -5.06±0.50V rms.

6.2.20.2.33 Insert in K148

- a. VERB 33, ENTER

6.2.20.2.34 Observe on CRT.

- a. V06 N01 Flashing
- b. R1 -00385
- c. R2 +00385
- d. R3 +00000

6.2.20.2.35 Record CRT indications.

- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -5.06±0.50V rms
- b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +5.06±0.50V rms
- c. CG 2249 YAW ATT ERROR - CDU DAC OUT 0.00±0.06V rms

6.2.20.2.36 Insert in K148.

- a. VERB 21 NOUN 01 ENTER
- b. 02545 ENTER
- c. 03363 ENTER
- d. VERB 33 ENTER

6.2.20.2.37 Observe on CRT.

- a. V06 N02 Flashing
- b. NO ATT ON
- c. R1 +00000 approximately
- d. R2 +00000 approximately
- e. R3 +00000 approximately

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- 6.2.20.3 TVC Test
- 6.2.20.3.1 The G/N Autopilot Control and SP8 Ready discretes shall be applied to the G/N Interface.
- 6.2.20.3.2 Set the OPTICS MODE selector on the Indicator Control Panel to MAN. Set the OPTICS ZERO switch to OFF.
- 6.2.20.3.3 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.3.4 Observe on CRT
- a. V 01 N10 Flashing  
b. R1 X7373  
c. R3 00030
- 6.2.20.3.5 Insert in K148
- a. V33 ENTR
- 6.2.20.3.6 Observe on CRT
- a. V 01 Noun 10 Flashing  
b. R1 37777  
c. R3 00031
- 6.2.20.3.7 Insert in K148
- a. V33 ENTER
- 6.2.20.3.8 Observe on CRT
- a. V06 N02 Flashing  
b. R1 +00385  
c. R2 -00385  
d. R3 +00003
- 6.2.20.3.9 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +10.12±1.00V rms  
b. CG 3721 SHAFT CDU DAC OUTPUT -10.12±1.00V rms
- 6.2.20.3.10 Insert in K148
- a. VERB 33, ENTER

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- 6.2.20.3.11 Observe on CRT
- a. V06 N 02 Flashing
  - b. R1 +00384
  - c. R2 -00384
  - d. R3 +00003
  - e. NO ATT OFF
- 6.2.20.3.12 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +10.12±1.00V rms
  - b. CG 3721 SHAFT CDU DAC OUTPUT -10.12±1.00V rms
- 6.2.20.3.13 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.3.14 Observe on CRT
- a. V06 N 02 Flashing
  - b. R1 +00160
  - c. R2 -00160
  - d. R3 +00003
- 6.2.20.3.15 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +4.22±0.42V rms
  - b. CG 3721 SHAFT CDU DAC OUTPUT -4.22±0.42V rms
- 6.2.20.3.16 Insert in KI48
- a. VERB 33 ENTER
- 6.2.20.3.17 Observe on CRT
- a. V06 N 02 Flashing
  - b. R1 +00135
  - c. R2 -00135
  - d. R3 +00003
- 6.2.20.3.18 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +3.86±0.36V rms
  - b. CG 3721 SHAFT CDU DAC OUTPUT -3.86±0.36V rms
- 6.2.20.3.19 Insert in KI48
- a. VERB 33 ENTER

6.2.20.3.20 Observe on CRT

|    |     |     |          |
|----|-----|-----|----------|
| a. | V06 | N02 | Flashing |
| b. | R1  |     | +00090   |
| c. | R2  |     | -00090   |
| d. | R3  |     | +00003   |

6.2.20.3.21 Record CRT indications

|    |                                 |                 |
|----|---------------------------------|-----------------|
| a. | CG 3722 TRUNNION CDU DAC OUTPUT | +2.38±0.24V rms |
| b. | CG 3721 SHAFT CDU DAC OUTPUT    | -2.38±0.24V rms |

6.2.20.3.22 Set the OPTICS SPEED switch on the Indicator Control panel to HI.

6.2.20.3.23 Insert in K148

a. VERB 33 ENTER

6.2.20.3.24 Observe on CRT

|    |     |      |          |
|----|-----|------|----------|
| a. | V06 | N 02 | Flashing |
| b. | R1  |      | +00000   |
| c. | R2  |      | +00000   |
| d. | R3  |      | +00003   |

6.2.20.3.25 While holding the Optics Hand Controller up and left (45°) no longer than 10 seconds, record CRT indications.

|    |                                 |                |
|----|---------------------------------|----------------|
| a. | CG 3722 TRUNNION CDU DAC OUTPUT | 0.00±0.12V rms |
| b. | CG 3721 SHAFT CDU DAC OUTPUT    | 0.00±0.12V rms |

6.2.20.3.26 Insert in K148

a. VERB 33 ENTER

6.2.20.3.27 Observe on CRT

|    |     |      |          |
|----|-----|------|----------|
| a. | V06 | N 02 | Flashing |
| b. | R1  |      | -00090   |
| d. | R2  |      | +00090   |
| d. | R3  |      | +00003   |

6.2.20.3.28 Record CRT indications

|    |                                 |                 |
|----|---------------------------------|-----------------|
| a. | CG 3722 TRUNNION CDU DAC OUTPUT | -2.38±0.24V rms |
| b. | CG 3721 SHAFT CDU DAC OUTPUT    | +2.38±0.24V rms |



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- 6.2.20.3.29 Set the OPTICS ZERO switch and the Indicator Control panel to ZERO for 30 seconds then return to OFF.
- 6.2.20.3.30 Insert in KI48
- a. VERB 33 ENTER
- 6.2.20.3.31 Observe on CRT
- a. V06 N 02 Flashing  
b. R1 -00135  
c. R2 +00135  
d. R3 +00003
- 6.2.20.3.32 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -3.56±0.36V rms  
b. CG 3721 SHAFT CDU DAC OUTPUT +3.56±0.36V rms
- 6.2.20.3.33 Insert in KI48
- a. VERB 33 ENTER
- 6.2.20.3.34 Observe on CRT
- a. V06 N 02 Flashing  
b. R1 -00160  
c. R2 +00160  
d. R3 +00003
- 6.2.20.3.35 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -4.22±0.42V rms  
b. CG 3721 SHAFT CDU DAC OUTPUT +4.22±0.42V rms
- 6.2.20.3.36 Insert in KI48
- a. VERB 33 ENTER
- 6.2.20.3.37 Observe on CRT
- a. V06 N 02 Flashing  
b. R1 -00384  
c. R2 +00384  
d. R3 +00003

6.2.20.3.38 Record CRT indications

- a. CG 3722 TRUNNION CDU DAC OUTPUT -10.12±1.00V rms
- b. CG 3721 SHAFT CDU DAC OUTPUT +10.12±1.00V rms

6.2.20.3.39 Insert in K148

- a. VERB 33 ENTER

6.2.20.3.40 Observe on CRT

- a. V08 N 08 Flashing
- b. R1 -00385
- c. R2 +00385
- d. R3 +00003

6.2.20.3.41 Record CRT indications

- a. CG 3722 TRUNNION CDU DAC OUTPUT -10.12±1.00V rms
- b. CG 3721 SHAFT CDU DAC OUTPUT +10.12±1.00V rms

6.2.20.3.42 Insert in K148

- a. V 34 ENTER
- b. V 41 N 20 ENTER
- c. V 41 N 20 ENTER
- d. +00000 ENTER
- e. +00000 ENTER
- f. +00000 ENTER

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APPENDIX I

| Signal  | Link | Nomenclature                    | G&N Test Requirement                         | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|---------------------------------|----------------------------------------------|----------------------------------------------|
| CG 1020 | 1    | +14 VDC CMC SUPPLY              | +14.0±0.4 VDC                                | 0%                                           |
| CG 1021 | 1    | +14V CMC SUPPLY NOISE RMS       | 0.2 VRMS MAX                                 | 0%                                           |
| CG 1030 | 1    | +4 VDC CMC SUPPLY               | +4.00±0.2 VDC                                | 0%                                           |
| CG 1031 | 1    | +4V CMC SUPPLY NOISE RMS        | 0.2 VRMS MAX                                 | 0%                                           |
| CG 1040 | 2    | +120 VDC PIPA SUPPLY            | +120±6.0 VDC                                 | 1%                                           |
| CG 1042 | 1    | +120 VDC PIPA SUP NOISE RMS     | 1.5 VRMS MAX                                 | 0%                                           |
| CG 1051 | 1    | +20 VDC PIPA SUPPLY             | +20.0±1.2 VDC                                | 0%                                           |
| CG 1052 | 1    | +20 VDC PIPA SUPPLY             | -20±2 VDC                                    | 0%                                           |
| CG 1053 | 1    | +20 VDC PIPA SUP NOISE RMS      | 1.0 VRMS MAX                                 | 0%                                           |
| CG 1070 | 1    | +4 VDC CDU SUPPLY               | +4.0±0.2 VDC                                 | 0%                                           |
| CG 1071 | 1    | +4 VDC CDU SUP NOISE RMS        | 0.1 VRMS MAX                                 | 0%                                           |
| CG 1100 | 1    | +28 VDC SUPPLY                  | -27.5±6.0 VDC                                | 0%                                           |
| CG 1110 | 2    | 2.5 VDC TM BIAS                 | +2.50±0.06 VDC                               | 0%                                           |
| CG 1201 | 2    | IMU 28V .8KC 1% 0° RMS          | 28.00±0.56VRMS                               | 1%                                           |
| CG 1202 | 1    | IMU 28V .8KC 5% - 90° RMS       | 28.0±1.4VRMS                                 | 0.33%                                        |
| CG 1203 | 1    | IMU 28V .8KC 0° RMS             | 28.0±2.1 VRMS                                | 0.33%                                        |
| CG 1207 | 1    | PH DIFF IMU 5% 0°, -90°         | -90±10°                                      | 2.3%                                         |
| CG 1211 | 1    | OPTX 28V .8KC 1% 0° RMS         | 28.00±0.56 VRMS                              | 0.33%                                        |
| CG 1211 | 2    | OPTX 28V .8KC 1% 0° RMS         | 28.00±0.56 VRMS                              | 1%                                           |
| CG 1212 | 1    | OPTX 28V .8KC 5% - 90° RMS      | 28.00±1.48 VRMS                              | 0.33%                                        |
| CG 1220 | 1    | PH DIFF OPTX 1% IMU 1%          | 0° ±10                                       | 2.3%                                         |
| CG 1331 | 2    | 3.2 KC 28V SUPPLY               | 28.6±0.56 VRMS                               | 1%                                           |
| CG 1336 | 1    | PH DIFF 3.2 KC 28V/CMC SYNC     | 0° ±10°                                      | 2.3%                                         |
| CG 1500 | 1    | +28 VDC IMU OPERATE BUS         | 28.8±3 VDC                                   | 0%                                           |
| CG 1501 | 1    | +28V IMU OPERATE BUS NOISE RMS  | 1.0 VRMS MAX                                 | 0%                                           |
| CG 1510 | 1    | +28 VDC IMU STANDBY BUS         | 28.8±3 VDC                                   | 0%                                           |
| CG 1511 | 1    | +28V IMU STANDBY BUS NOISE RMS  | 1.0 VRMS MAX                                 | 0%                                           |
| CG 1520 | 1    | +28 VDC CMC OPERATE BUS         | 28.8±3 VDC                                   | 0%                                           |
| CG 1521 | 1    | +28V CMC OPERATE BUS NOISE RMS  | 2.0 VRMS MAX                                 | 0%                                           |
| CG 1530 | 1    | +28 VDC OPTX OPERATE BUS        | 28.8±3 VDC                                   | 0%                                           |
| CG 1531 | 1    | +28V OPTX OPERATE BUS NOISE RMS | 2.0 VRMS MAX                                 | 0%                                           |
| CG 2001 | 2    | X PIPA SG O/P                   | 5 VRMS max                                   | 3%                                           |
| CG 2021 | 2    | Y PIPA SG O/P                   | 5 VRMS max                                   | 3%                                           |
| CG 2041 | 2    | Z PIPA SG O/P                   | 5 VRMS max                                   | 3%                                           |
| CG 2108 | 1    | IG SERVO ERROR QUAD             | 0.0±1.2 VRMS                                 | 3.6%                                         |
| CG 2112 | 2    | IG 1X RESOLVER O/P SIN          | 18.38±1.84 VRMS @ 45°                        | 2.5%                                         |
| CG 2113 | 2    | IG 1X RESOLVER O/P COS          | 18.38±1.84 VRMS @ 45°                        | 2.5%                                         |
| CG 2117 | 2    | IG SERVO ERROR IN PHASE         | 0.0±60 mv RMS @ null                         | 1.4%                                         |
| CG 2120 | 1    | IG TORQUE MOTOR CURRENT         | 0.125 amp max during Fine Alignment Torquing | 0%                                           |

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APPENDIX I (Continued)

| Signal  | Link | Nomenclature                   | G&N Test Requirement                     | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|--------------------------------|------------------------------------------|----------------------------------------------|
| CG 2138 | 1    | MG SERVO ERROR QUAD            | 0.0±1.2 VRMS                             | 3.6%                                         |
| CG 2142 | 2    | MG 1X RESOLVER O/P SIN         | 18.38±1.84 VRMS @ 45°                    | 2.5%                                         |
| CG 2143 | 2    | MG 1X RESOLVER O/P COS         | 18.38±1.84 VRMS @ 45°                    | 2.5%                                         |
| CG 2147 | 2    | MG SERVO ERROR IN PHASE        | 0.0±60 mv rms @ null                     | 1.4%                                         |
| CG 2150 | 1    | MG TORQUE MOTOR CURRENT        | 0.125 amp max during Fine Align Torquing | 0%                                           |
| CG 2166 | 1    | OG SERVO ERROR QUAD            | 0.0±1.2 VRMS                             | 3.6%                                         |
| CG 2172 | 2    | OG 1X RESOLVER O/P SIN         | 18.38±1.84 VRMS @ 45°                    | 2.5%                                         |
| CG 2173 | 2    | OG 1X RESOLVER O/P COS         | 18.38±1.84 VRMS @ 45°                    | 2.5%                                         |
| CG 2177 | 2    | OG SERVO ERROR IN PHASE        | 0.0±60 mv RMS @ null                     | 1.4%                                         |
| CG 2180 | 1    | OG TORQUE MOTOR CURRENT        | 0.125 amp max during Fine Align Torquing | 0%                                           |
| CG 2219 | 1    | PITCH ATT ERROR-CDU DAC O/P    | 5.06±0.5 VRMS @ 17°                      | 0.67%                                        |
| CG 2219 | 2    | PITCH ATT ERROR-CDU DAC O/P    | 5.06±5 VRMS @ null                       | 1%                                           |
| CG 2220 | 1    | IG CDU FINE ERROR              | 0.0±0.07 VRMS @ null                     | 0.29%                                        |
| CG 2221 | 1    | IG CDU COARSE ERROR            | 0.0±0.68 VRMS at null                    | 0.29%                                        |
| CG 2249 | 1    | YAW ATT ERROR-CDU DAC O/P      | 5.06±0.5 VRMS at 17°                     | 0.67%                                        |
| CG 2249 | 2    | YAW ATT ERROR-CDU DAC O/P      | 5.06±0.5 VRMS @ null                     | 1%                                           |
| CG 2250 | 1    | MG CDU FINE ERROR              | 0.0±0.07 VRMS at null                    | 0.29%                                        |
| CG 2251 | 1    | MG CDU COARSE ERROR            | 0.0±0.68 VRMS at null                    | 0.29%                                        |
| CG 2279 | 1    | ROLL ATT ERROR-CDU DAC O/P     | 5.06±0.5 VRMS at 17°                     | 0.67%                                        |
| CG 2279 | 2    | ROLL ATT ERROR-CDU DAC O/P     | 5.06±0.5 VRMS @ null                     | 1%                                           |
| CG 2280 | 1    | OG CDU FINE ERROR              | 0.0±0.07 VRMS at null                    | 0.29%                                        |
| CG 2281 | 1    | OG CDU COARSE ERROR            | 0.0±0.68 VRMS                            | 0.29%                                        |
| CG 2300 | 2    | PIPA TEMPERATURE               | 130.5±1.5° F Operate Mode                | 2%                                           |
| CG 2301 | 1    | IRIG TEMPERATURE               | 135±2.5° F in Operate                    | 2%                                           |
| CG 2301 | 2    | IRIG TEMPERATURE               | 135±2.5° F in Operate                    | 1%                                           |
| CG 3011 | 1    | TRUNNION CDU FINE ERROR        | 0.0±0.07 VRMS at null                    | 0.29%                                        |
| CG 3011 | 2    | TRUNNION CDU FINE ERROR        | 0.0±0.07 VRMS @ null                     | 1%                                           |
| CG 3021 | 1    | SHAFT CDU FINE ERROR           | 0.0±0.07 VRMS at null                    | 0.29%                                        |
| CG 3021 | 2    | SHAFT CDU FINE ERROR           | 0.0±0.07 VRMS @ null                     | 1%                                           |
| CG 3117 | 1    | SXT SHAFT SERVO ERROR IN PH    | -0.25 to -2.00 VRMS at Hi Rate           | 1.1%                                         |
| CG 3118 | 1    | SXT TRUNNION SERVO ERROR IN PH | -0.25 to -2.00 VRMS at Hi Rate           | 1.1%                                         |
| CG 3140 | 1    | SXT SHAFT TACH O/P             | 3.3±1.3 VRMS at Hi Rate                  | 1.1%                                         |
| CG 3140 | 2    | SXT SHAFT TACH O/P             | 3.3±1.3 VRMS @ Hi Rate                   | 2%                                           |
| CG 3145 | 1    | SXT SHAFT MTR CONTROL WINDING  | +0.5 to 4.00 VRMS at Med Rate            | 1.1%                                         |
| CG 3150 | 1    | SXT TRUNNION TACH O/P          | 3.3±1.3 VRMS at Hi Rate                  | 1.1%                                         |
| CG 3150 | 2    | SXT TRUNNION TACH O/P          | 3.3±1.3 VRMS @ Hi Rate                   | 2%                                           |

APPENDIX I (Continued)

| <u>Signal</u> | <u>Link</u> | <u>Nomenclature</u>              | <u>G&amp;N Test Requirement</u> | <u>PSAAM and/or SCA Uncertainty % of Full Scale</u> |
|---------------|-------------|----------------------------------|---------------------------------|-----------------------------------------------------|
| CG 3155       | 1           | EXT TRUNNION MTR CONTROL WINDING | +0.25 to +2.00 VRMS at Med Rate | 1.1%                                                |
| CG 3160       | 1           | SCT SHAFT TACH O/P               | 3.3±1.3 VRMS at Hi Rate         | 1.1%                                                |
| CG 3160       | 2           | SCT SHAFT TACH O/P               | 3.3±1.3 VRMS at Hi Rate         | 2%                                                  |
| CG 3170       | 1           | SCT TRUNNION TACH O/P            | 0.85±0.35 VRMS at Hi Rate       | 1.1%                                                |
| CG 3170       | 2           | SCT TRUNNION TACH O/P            | 0.85±0.35 VRMS at Hi Rate       | 2%                                                  |
| CG 3721       | 2           | SHAFT CDU DAC O/P                | 10.12±1.00 VRMS at 17"          | 1%                                                  |
| CG 3722       | 2           | TRUNNION CDU DAC O/P             | 10.12±1.00 VRMS at 17"          | 1%                                                  |
| CG 4300       | 1           | CMC TEMP                         | 87.5±42.5° F                    | 0.23%                                               |
| CG 6020       | 1           | PIPA CAL MODULE TEMP             | 72.5±27.5° F                    | 0.23%                                               |
| CG 6021       | 1           | DMU 800 cps 5% TEMP (PSA)        | 90±30° F                        | 0%                                                  |

PSAAM OUTPUT is the source of Link 1 signals. SCA OUTPUT is the source of Link 2 signals.

ADDENDUM II

Deleted

ADDENDUM III

SCOPE: The following changes are required to make ND1002348 applicable as a G&N System Technical support document for CSM 101.

- Change 1. Add paragraph 6.1.1.7 as follows:
- 6.1.1.7 Data from the on board tape recorder shall be made available and the following signals verified:
- a. IG TORQUE MOTOR CURRENT (CG 2120) shall be less than 0.125 amp max.
  - b. OG TORQUE MOTOR CURRENT (CG 2180) shall be less than 0.125 amp max.
  - c. MG TORQUE MOTOR CURRENT (CG 2150) shall be less than 0.125 amp max.
- Change 2. Paragraph 6.2.1.3.8.5 change the last sentence to read as follows:
- On the Event Recorder verify that the IMU HTR Current discrete (CG 2302 FQ) is ON and that the IMU Blower Current discrete (CG 2303 FQ) is OFF over the last 2 hour period (occasionally discrete may cycle).
- Change 3. Add paragraph 6.2.4.6.1 as follows:
- 6.2.4.6.1 On the analog recorder verify that CG 1211 FQ, OPTICS 28V 800 cps 1% deg. RMS voltage is 28.0±0.6 VAC.
- Change 4. Add paragraph 6.2.20.2.5.1 and 6.2.20.2.32.1 as follows:
- 6.2.20.2.5.1 Verify on the analog recorder the following signals:
- a. CG 2279 FQ ROLL ATT ERROR - CDU DAC OUT +5.06±0.50 VRMS
  - b. CG 2219 FQ PITCH ATT ERROR - CDU DAC OUT -5.06±0.50 VRMS
  - c. CG 2249 FQ YAW ATT ERROR - CDU DAC OUT +5.06±0.50 VRMS
- 6.2.20.2.32.1 Verify on the analog recorder the following signals:
- a. CG 2279 FQ ROLL ATT ERROR - CDU DAC OUT -5.06±0.50 VRMS
  - b. CG 2219 FQ PITCH ATT ERROR - CDU DAC OUT +5.06±0.50 VRMS
  - c. CG 2249 FQ YAW ATT ERROR - CDU DAC OUT -5.06±0.50 VRMS

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- Change 5 Add new paragraph 6.1.1.8 as follows:
- From the on board tape recorder verify the presence of the following signals:
- a. VIB NB ROLL (CG 6001)
  - b. VIB NB PITCH (CG 6002)
  - c. VIB NB YAW (CG 6003)
- Change 6 Paragraph 6.2.1.3.8.5 add to the first sentence the following:
- "... PIPA TEMP (CG 2300) and IRIG TEMP (CG 2301) on the CRT."
- Add Paragraph 6.2.3.1.13 as follows:
- 6.2.3.1.13 "80 minutes after the application of IMU OPERATE power record IRIG TEMP (CG 2301) displayed on the CRT".
- Paragraph 6.2.3.1.14, add to the first sentence the following:
- "... PIPA TEMP (CG 2300) and IRIG TEMP (CG 2301) every..."
- Paragraph 6.2.3.1.15 change to read as follows:
- "When 2 hours have elapsed since the application of IMU OPERATE power record PIPA TEMP and IRIG TEMP. PIPA TEMP shall be  $130.5^{\circ} \pm 1.5^{\circ} F$ . IRIG TEMP shall be  $135^{\circ} \pm 2.5^{\circ} F$ . PIPA TEMP shall be within  $0.5^{\circ} F$  of that recorded in 6.2.3.1.12 and 6.2.1.3.8.4. IRIG TEMP shall be within  $0.5^{\circ} F$  of that recorded in 6.2.3.1.12".
- Paragraph 6.2.5.2.16, add the following to Table VI:
- "14 CG 2301 IRIG TEMPERATURE"
- Add Paragraph 6.2.1.3.8.4.1 as follows:
- 6.2.1.3.8.4.1 The IRIG TEMP on the CRT shall be monitored at 15 min, 1 hour, and 2 hours after 6.2.1.3.8.2 is executed to insure that the IRIG TEMP (CG 2301) is within  $\pm 3.0$  degrees of the PIPA Temperature.
- Change 7 Paragraph 6.1.1.6, add item "F" as follows:
- "F" The TRACKER switch on G&N Indicator Control Panel shall be set to OFF.



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- Change 8 Replace paragraph 6.2.3.1.2 with the following:
- 6.2.3.1.2 Switches and selectors on the G&N Indicator control panel shall be set as follows:
- a. OPTICS MODE to MANUAL
  - b. CONTROLLER COUPLING to DIRECT
  - c. CONTROLLER SPEED to MED
  - d. TELESCOPE TRUNNION to SLAVE to SXT
  - e. RETICLE BRIGHTNESS to minimum brightness position.
- Change 9 Replace paragraph 6.2.3.2.3.2 with the following:
- 6.2.3.2.3.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE on the G&N Indicator Control Panel to ZERO. Wait 15 seconds.
- Change 10 Replace paragraph 6.2.5.1.2 with the following:
- 6.2.5.1.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the following switches on the G&N Indicator Control Panel to the positions designated:
- a. OPTICS MODE to ZERO
  - b. CONTROLLER MODE to DIRECT
  - c. CONTROLLER SPEED to LO
  - d. TELESCOPE TRUNNION to SLAVE to SXT
  - e. RETICLE BRIGHTNESS to minimum brightness position.
- Change 11 Replace paragraph 6.2.5.2.1 with the following:
- 6.2.5.2.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set or verify the following G&N Indicator Control Panel switches to the positions indicated.
- a. CONDITION LAMPS to ON
  - b. OPTICS MODE to ZERO
  - c. CONTROLLER COUPLING to DIRECT
  - d. CONTROLLER SPEED to LO
  - e. TELESCOPE TRUNNION to SLAVE to SXT
  - f. RETICLE BRIGHTNESS to minimum brightness position.
- Change 12 Replace paragraph 6.2.9.23 with the following:
- 6.2.9.23 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to CMC.
- Change 13 Replace sections 6.2.10 and 6.2.11 with the following:
- 6.2.10 Zero Optics Test
- 6.2.10.1 Set the G&N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.

**NOTE:** Proceed with this test if 6.2.3 Operate Power on Test has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 Turn On Procedure before proceeding.

#### INITIALIZATION

6.2.10.2

Insure that the following switches on the G&N Indicator Control Panel are set as follows:

- a. TELESCOPE TRUNNION to SLAVE to EXT
- b. CONTROLLER COUPLING to DIRECT
- c. CONTROLLER SPEED to HI
- d. OPTICS MODE to MAN

6.2.10.3

Monitor the Optics CDU's by entering VERB 16 NOUN 91 into K-148. Press the ENTER pushbutton

6.2.10.4

**CAUTION:** See Paragraph 5.1.2.11 before proceeding Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Verify the Optics have zeroed properly by observing the following on R1 and R2 of the CRT.

- a.  $R1 = +0.00^\circ +0.02^\circ, -0.03^\circ$  (Shaft Angle)
- b.  $R2 = +0.000^\circ +0.006^\circ, -0.007^\circ$  (Trunnion Los Angle)

6.2.10.4.1

Enter the following:

VERB 01            NOUN 10            ENTER  
00033            ENTER  
Verify R1 = XXX6X

6.2.10.4.2

Set the OPTICS MODE switch to CMC. Enter the following:

ENTER  
00033, ENTER  
Verify R1 = XXX6X

#### OPTICS TIME TO ZERO TEST

6.2.10.5

Deleted.

6.2.10.6 Deleted.

6.2.10.7 Deleted.

6.2.10.8 Deleted.

6.2.10.9 Deleted.

6.2.10.10 Deleted.

6.2.10.11 Deleted.

6.2.10.12 Insert the Inflight Tool (V36601405) into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eyepiece while turning the tool until the TPAC reads  $+5^{\circ}$ . Remove the tool from the trunnion tool input.

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- 6.2.10.13 Insert the Inflight Tool (V36601405) into the Shaft Tool Input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to -3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool.
- 6.2.10.14 Insert the Inflight Tool (V36601405) into the Trunnion Tool input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool.
- 6.2.11 OPTICS Coordinate Transformation Control Test.
- 6.2.11.1 Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.
- NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding.
- INITIALIZATION
- 6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.
- a. TELESCOPE TRUNNION to SLAVE to SXT
  - b. CONTROLLER COUPLING to DIRECT
  - c. CONTROLLER SPEED to HI
  - d. OPTICS MODE to MAN
- 6.2.11.3 Enter the following into the K-Start:
- VERB 16    NOUN 91    ENTR
- 6.2.11.4 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS MODE switch to MAN.
- 6.2.11.5 Set up the analog recorders to monitor the following measurements.
- a. CG 3170 SCT Trunnion Tachometer Output

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RESOLVED MODE PHASING AND IMAGE RATE TEST

- 6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until  $R1 = +225.00$  and  $R2 = +10.000$  on the CRT and the DSKY's.
- 6.2.11.7 Set the CONTROLLER COUPLING switch on the G&N Panel to RSLV and the CONTROLLER SPEED switch to MED.
- 6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.
- 6.2.11.9 Record time. Quickly displace the OPTICS CONTROL STICK  $45 \pm 10$  degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at  $45 \pm 10$  degrees. When target leaves the SCT upper right field of view press MARK pushbutton. The PROG alarm light shall light.
- 6.2.11.10 From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) and the PROG alarm discrete for the period during which the OPTICS CONTROL STICK was being displaced above. The shaft CDU angle shall be  $225 \pm 10.00$  degrees at the time the PROG alarm occurred. The elapsed time from time at OPTICS CONTROL STICK displacement to the time the PROG alarm discrete is obtained shall be 19 to 32 seconds.
- CSC AMPLIFIER SHAFT AND TRUNNION DRIVE TEST
- 6.2.11.11 Set the CONTROLLER COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the Optics until  $R = +225.00$  and  $R2 = +10.000$ . Set the CONTROLLER COUPLING switch to RSLV.
- 6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.
- 6.2.11.13 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the CONTROLLER COUPLING switch on the G&N Panel to DIRECT. Set the OPTICS MODE switch to ZERO. After 15 seconds, return the switch to MAN.

**Change 14**

Replace section 6.2.12 with the following:

**6.2.12 OPTICS FUNCTIONAL TEST**

**6.2.12.1 Deleted.**

**6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:**

- a. +28 VDC OPTX OPERATE BUS (CG 1630) is 28.8±3 VDC. Record the indication on the CRT.
- b. CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.
- c. CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT.

**6.2.12.3 Deleted.**

**6.2.12.4 Insure that the Optics Control switches on the G&N Indicator Control Panel are set as follows:**

- a. OPTICS MODE to MAN
- b. CONTROLLER SPEED to LO
- c. CONTROLLER COUPLING to DIRECT
- d. TELESCOPE TRUNNION to SLAVE to SXT

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- 6.2.12.5 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch to ZERO. After 15 seconds  
return to MAN.
- 6.2.12.6 Resolution Checks
- 6.2.12.6.1 SXT Resolution Check - MSO only.
- 6.2.12.6.1.1 Sight through the SXT eyepiece. Using the OPTICS CONTROL  
STICK, adjust the SXT to obtain the best reflected field of  
view of the 5-inch autocollimator reticle engravings at the  
center of view.
- 6.2.12.6.1.2 Note that the autocollimator reticle contains a series of lines  
of different thickness and width. Each set of lines is marked  
with a number (20, 15, 10, 7, 5, 3) which indicates the angle  
subtended by one line and one space. View each set of lines to  
determine the lowest numbered set in which resolution between  
lines (ability to distinguish separate distinct lines within a  
set) can be made. Record the number associated with that set  
of lines. The SXT resolution shall be at least 10 arc seconds  
at the center of the field of view.
- 6.2.12.6.2 SCT Resolution Check
- 6.2.12.6.2.1 Sight through the SCT EYEPIECE. Using the OPTICS CON-  
TROL STICK adjust the SCT to obtain the best view of the SCT  
RESOLUTION CHART held in the Optics line of sight.
- 6.2.12.6.2.2 Note the chart contains sets of lines. View each set of lines  
to determine the lowest numbered set in which the resolution  
between lines (ability to distinguish separate lines within a  
set) can be made. The SCT shall have a resolution of at least  
3 arc minutes at the center of the field of view.
- 6.2.12.7 Slave Telescope Mode Checks
- 6.2.12.7.1 Verify/perform OPTICS POWER ON TEST per paragraph  
6.2.3.2.
- 6.2.12.7.2 Set/Verify following switches on G&N INDICATOR CONTROL  
PANEL:
- a. TELESCOPE TRUNNION - SLAVE to SXT
  - b. CONTROLLER COUPLING - DIRECT
  - c. CONTROLLER SPEED - HI

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- 6.2.12.7.3 Monitor OCDU's by entering VERB 16 NOUN 91 into K-148.  
Press ENTER.
- 6.2.12.7.4 Set OPTICS MODE to MAN
- 6.2.12.7.5 Using the Optics Hand Controller drive the optics until:  
R1 = +010.00±001.00 (SHAFT)  
R2 = +10.000±01.000 (TRUNNION)
- 6.2.12.7.6 Verify on the CRT and Optics Panel:  
SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.7 Set the TELESCOPE TRUNNION on the G&N INDICATOR  
CONTROL PANEL to 0°.
- 6.2.12.7.8 Verify:  
SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = 0.0° ±0.22 DEG  
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.9 Set the TELESCOPE TRUNNION on the G&N INDICATOR  
CONTROL PANEL to OFFSET 25°.
- 6.2.12.7.10 Verify on CRT and Optics Panel:  
SHAFT TPAC = R1±0.11 DEG  
TRUN TPAC = 25° ±1.00 DEG  
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.11 On the G&N INDICATOR CONTROL PANEL set the TELESCOPE  
TRUNNION to SLAVE to SXT.
- 6.2.12.7.12 Verify on CRT and Optics Panel:  
SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = R2±0.22 DEG
- 6.2.12.7.13 CAUTION: See Paragraph 5.1.2.11 before proceeding. On  
the G&N INDICATOR CONTROL PANEL set the OPTICS MODE  
to ZERO. Wait 15 seconds.
- 6.2.12.7.14 Verify on CRT and OPTICS PANEL:  
R1 = 000.00 +000.02, -000.03  
R2 = 00.000 +00.006, -00.007°  
SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.15 If Optics testing will not be continued, set the G&N POWER-  
OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.8 SXT Parallelism Tests



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- 6.2.12.8.1 Remove the plug from the base of the EXT eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light.
- NOTE: If needed to reduce external light, place a photographer's hood over the optics head.
- 6.2.12.8.2 EXT Auto Collimator Parallelism Test - MSO only
- 6.2.12.8.2.1 Using the OPTICS CONTROL STICK drive the EXT S&LOS Trunnion to  $+15.00^{\circ} \pm 2^{\circ}$  as indicated in R2 of the DSKY. Maintain a Shaft CDU angle of  $000.00 \pm 0.10$  degree.
- 6.2.12.8.2.2 Sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to superimpose the EXT LLOS horizontal reticle image upon the autocollimator horizontal filar. Record the autocollimator reading.
- 6.2.12.8.2.3 Repeat 6.2.12.8.2.2 twice. Calculate and record the average of the three autocollimator readings.
- 6.2.12.8.2.4 Set the OPTICS MODE switch to ZERO. After 15 seconds return the OPTICS MODE switch to MAN.
- 6.2.12.8.2.5 Again sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to bring the EXT S&LOS horizontal reticle and autocollimator horizontal filar images to coincide. Record the autocollimator reading.
- 6.2.12.8.2.6 Repeat 6.2.12.8.2.5 twice. Calculate and record the average of the three autocollimator readings. The average value obtained here shall not differ from that obtained in 6.2.12.8.2.3 by more than 10 arc seconds.
- 6.2.12.8.3 Deleted.
- 6.2.12.8.3.1 Deleted.
- 6.2.12.8.3.2 Deleted.

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- 6.2.12.8.3.3 Deleted.
- 6.2.12.8.3.4 Deleted.
- 6.2.12.9 EXT, CMC FUNCTION CHECK
- 6.2.12.9.1 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch to ZERO. After 15 seconds,  
return the switch to MAN.
- 6.2.12.9.2 Sight through the EXT. Using the Control Stick align the  
EXT SLOS with Optical Target No. 1.
- 6.2.12.9.3 When aligned record the value of Shaft and Trunnion CDU's  
from the CRT.
- 6.2.12.9.4 Sight through the EXT. Using the Control Stick align the  
EXT SLOS with Optical Target No. 2.
- 6.2.12.9.5 When aligned, record the value of Shaft and Trunnion CDU's  
from the CRT.
- 6.2.12.9.6 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch on the G&N Indicator Control  
Panel to ZERO. After 15 seconds set the switch to MAN,  
then CMC.
- 6.2.12.9.7 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the  
value for Shaft from 6.2.12.9.3 into the DSKY and press ENTER.  
Enter the value for Trunnion from 6.2.12.9.3 into the DSKY  
and press ENTER.
- 6.2.12.9.8 Sight through the EXT. The SLOS should be approximately  
centered on the Optical Target No. 1. Record the value of  
Shaft and Trunnion CDU's from the CRT. The difference  
between these values and the corresponding values recorded  
in 6.2.12.9.3 shall be less than 0.06 degree for the Shaft  
and 0.03 degrees for the Trunnion. Record the difference.
- 6.2.12.9.9 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the  
value for Shaft from 6.2.12.9.5 into the DSKY and press the  
ENTER pushbutton. Enter the value for Trunnion from  
6.2.12.9.5 into the DSKY and press the ENTER pushbutton.

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- 6.2.12.9.10 Sight through the SXT. The StLos should be approximately centered on the Optical Target No. 2. Press the MARK push-button and record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.11 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds.
- 6.2.12.9.12 If OPTICS testing will not continue, set the G&N Power Optics Switch on the LEB Lighting Panel to OFF.
- Replace Section 6.2.13 with the following:
- 6.2.13 Optics Slew Rate Test
- 6.2.13.1 Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following signals on the CRT.
- a. +28 VDC OPTICS OPERATE BUS (CG 1530) is +29.0 ±3.0 VDC
  - b. OPTX 28V 800 cps 1% 0° ph not flashing on the CRT
  - c. OPTX 28V 800 cps 5% -90° not flashing on CRT
- 6.2.13.1.1 Verify and/or set the following switches on the G&N Indicator Control Panel to the positions indicated.
- a. TELESCOPE TRUNNION to SLAVE to SXT
  - b. CONTROLLER COUPLING to DIRECT
  - c. CONTROLLER SPEED to HI
  - d. OPTICS MODE to MAN
  - e. TRACKER to OFF
- 6.2.13.2 Monitor the OCDU's by entering VERB 16 NOUN 91 into KI48. Press the ENTER pushbutton. Insure RECORD DSKY and RECORD DOWNLINK of R-145 are on.
- TRUNNION SLEW RATE - HIGH SPEED
- 6.2.13.3 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS MODE switch on the G&N Indicator Panel to MAN.
- 6.2.13.3.1 During the Trunnion Slew Rate Test monitor and verify the following signals:
- | Signals                                                | Requirement         |
|--------------------------------------------------------|---------------------|
| a. SXT TRUNNION TACH O/P (CG 3150), FQ 3.3±1.3 VRMS    |                     |
| b. SCT TRUNNION TACH O/P (CG 3170), FQ -0.85±0.35 VRMS |                     |
| c. SCT Trunnion Servo Error in Phase (CG 3118)         | -0.25 to -2.00 VRMS |
- NOTE: Read and understand 6.2.13.4 before proceeding. Do not hold Control Stick at upper limit more than 10 seconds or exceed a trunnion angle of 85°.

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- 6.2.13.4 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 7 seconds release the control stick.
- 6.2.13.5 Perform the following calculations:
- From the uplink file tape, the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the slew rate test was being performed.
- Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.
- The Trunnion slew rate shall be  $10.0 \pm 2.0$  deg/sec.
- SHAFT SLEW RATE - HI SPEED
- 6.2.13.6 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.
- 6.2.13.6.1 During the Shaft Slew Rate Test monitor and verify the following signals:
- | Signal                                     | Requirements            |
|--------------------------------------------|-------------------------|
| a. SXT SHAFT TACHO/P (CG 3140), FQ         | $3.3 \pm 1.3$ VRMS      |
| b. SCT SHAFT TACH O/P (CG 3160), FQ        | $-3.3 \pm 1.3$ VRMS     |
| c. SXT Shaft Servo Error Inphase (CG 3117) | $-0.25$ to $-2.00$ VRMS |
- NOTE: Read and understand step 6.2.13.7 before proceeding.  
Do not hold Control Stick at right limit for more than 10 seconds or exceed a shaft angle of  $250^\circ$ .
- 6.2.13.7 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 7 seconds release the control stick.
- 6.2.13.8 Perform the following calculations:
- From the uplink file tape, the compressed data tape or the PCM tape request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the slew rate was being performed.
- Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.
- The Shaft slew rate shall be  $19.5 \pm 3.9$  deg/sec.
- TRUNNION SLEW RATE - MED SPEED.
- 6.2.13.9 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the OPTICS CONTROLLER SPEED switch to MED.

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NOTE: Read and understand 6.2.13.10 before proceeding.  
Do not hold control stick at upper limit for more than 20 seconds.

- 6.2.13.10 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.
- Record the SXT TRUN MTR Control Winding (CG 3155) and SXT TRUN TACH (CG 3150) signals while slewing the Optics. CG 3155 shall be  $\pm 0.25$  to  $\pm 2.00$  VRMS. CG 3150 shall be  $\pm 0.33 \pm 0.13$  VRMS.
- 6.2.13.11 Perform the following calculations:
- From the uplink file tape the compressed data tape, or the PCM tape, request a data reduction of the Trunnion CDU registers (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.
- The Trunnion slew rate shall be  $1.0 \pm 0.2$  deg/sec.
- SHAFT SLEW RATE - MED SPEED
- 6.2.13.12 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set OPTICS MODE switch to MAN.
- NOTE: Read and understand 6.2.13.13 before proceeding.  
Do not hold control stick at the right limit for more than 20 seconds.
- 6.2.13.13 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.
- Record the SXT SHAFT MTR Control Winding (CG 3145) and SXT Shaft Tach (CG 3140) signals while slewing the Optics. CG 3145 shall be  $\pm 0.50$  to  $4.00$  VRMS. CG 3140 shall be  $0.33 \pm 0.13$  VRMS.
- 6.2.13.14 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) for the 12 second period during which the rate test was being performed.

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Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.

The Shaft slew rate shall be  $2.00 \pm 0.4$  deg/sec.

TRUNNION SLEW RATE - LO SPEED

- 6.2.13.15 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the CONTROLLER SPEED switch to LO.

- 6.2.13.15.1 During the Trunnion Slew Rate Test monitor and verify the following signals:

| Signal                                                      | Requirement |
|-------------------------------------------------------------|-------------|
| a. TRUNNION CDU FINE ERROR (CG 3001), FQ $\pm .07$ VRMS MAX |             |

NOTE: Read and understand 6.2.13.16 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.

- 6.2.13.16 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.

- 6.2.13.17 Perform the following calculations:

From the uplink file tape, the compressed data tape or the PCM tape request a data reduction of the Trunnion CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the slew rate test was being performed.

Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.

The Trunnion Slew Rate shall be  $0.10 \pm 0.02$  deg/sec.

SHAFT SLEW RATE - LO SPEED

- 6.2.13.18 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.

- 6.2.13.18.1 During the Shaft Slew Rate test monitor and verify the following signal:

| Signal                                                  | Requirement |
|---------------------------------------------------------|-------------|
| a. SHAFT CDU FINE ERROR (CG 3021) FQ $\pm .07$ VRMS MAX |             |

NOTE: Read and understand 6.2.13.19 before proceeding. Do not hold control stick at right limit for more than 20 seconds.

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- 6.2.13.19 Record time. Push and hold the Optics Control stick to its right limit. After approximately 12 seconds release the control stick.
- 6.2.13.20 Perform the following calculations:  
From the uplink file tape, the compressed data tape or the PCM tape request a data reduction of the CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the slow rate test was being performed.  
Calculate the rate by dividing the  $\Delta$ CDU angle by the elapsed time.  
The Shaft Slew Rate shall be  $0.20 \pm 0.04$  deg/sec.  
OPTICS HAND CONTROLLER DRIFT RATE CHECK - LO SPEED
- 6.2.13.21 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Record time. Wait 60 seconds.
- 6.2.13.22 Perform the following calculations:  
From the uplink file tape, the compressed data tape or the PCM tape request a data reduction of the Trunnion and Shaft CDU registers (addresses 35 and 36 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 60 second period during which the drift rate test was being performed.  
Calculate the drift rates by dividing the  $\Delta$ CDU angle by the elapsed time.  
The Trunnion drift rate shall be less than .0167 deg/sec.  
The Shaft drift rate shall be less than .0333 deg/sec.
- 6.2.13.23 If OPTICS testing will not continue, set the G/N Power-Optics switch on the LEB Lighting Control Panel to OFF.
- Change 16 Replace Paragraph 6.2.17.5 with the following:
- 6.2.17.5 CAUTION: See Paragraph 5.1.2.11 before proceeding. On the G&N Indicator Control Panel set the following switches to the position indicated.
- TELESCOPE TRUNNION to SLAVE to EXT
  - CONTROLLER COUPLING to DIRECT
  - CONTROLLER SPEED to LO
  - OPTICS MODE to ZERO.

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Change 17 Replace paragraph 6.2.17.20 with the following:

6.2.17.20 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN. Enter VERB 33, ENTER into the DSKY.

Change 18 Replace paragraphs 6.2.18.8.1, 6.2.18.8.11, 6.2.18.8.12 and 6.2.18.8.14 with the following:

6.2.18.8.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. After 240 minutes from T<sub>0</sub>, set the OPTICS MODE switch to ZERO.

6.2.18.8.11 Set the CONTROLLER SPEED switch to HI. Using the Optics Hand Controller, drive the EXT SLOS to the approximate position of Target 2.

6.2.18.8.12 Set the CONTROLLER SPEED switch to LO. Using the Optics Hand Controller, align the EXT SLOS to Target 2 and press the MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied, press the MARK REJECT pushbutton and repeat this step.

6.2.18.8.14 CAUTION: See Paragraph 5.1.2.11 before proceeding. Enter VERB 34, ENTER into the DSKY. Observe the PROGRAM display change to 03. Set the Optics Mode Switch on the G&N Indicator Control Panel to ZERO.

Change 19 Replace paragraphs 6.2.20.3.2, 6.2.20.3.22, and 6.2.20.3.29 and replace with the following:

6.2.20.3.2 Set the OPTICS MODE selector on the Indicator Control panel to MAN.

6.2.20.3.22 Set the OPTICS CONTROLLER SPEED switch on the Indicator Control Panel to HI.

6.2.20.3.29 Set the OPTICS MODE switch on the Indicator Control panel to ZERO for 30 seconds then return to MAN.



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POST INSTALLATION CHECKOUT PROCESS  
SPECIFICATION FOR THE APOLLO GUIDANCE &  
NAVIGATION SYSTEM BLOCK II-KSC

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|         |                    |             |                                      |           |      |
|         |                    |             |                                      |           |      |

This specification consists of page 1 to 144 inclusive.

|           |         |                         |                      |                                    |
|-----------|---------|-------------------------|----------------------|------------------------------------|
| APPROVALS | NASA/MS | W.S. Swingle<br>2/17/67 | E. Austin<br>2/17/67 | R. D. Petryk<br>D. A. Ziemer<br>AC |
|           |         |                         |                      |                                    |

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5.3.1 Measurements and tolerances as stated herein are basic G&N System performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. PSAAM and Signal Conditioner stability uncertainties are included in Appendix I.

5.4 Test Sequence

5.4.1 The test sequence should follow the flow chart of Figure 1, except for 6.2.8, Turn-On and Turn-Off procedure, which may be performed as the requirement arises. The following is a complete listing of tests.

| Paragraph No. | Test Title                                    |
|---------------|-----------------------------------------------|
| 6.2.1         | Application of Standby Power to G&N System    |
| 6.2.2         | CMC Operational Test                          |
| 6.2.3         | Operate Power On Test                         |
| 6.2.4         | G&N Power Supplies Test                       |
| 6.2.5         | General Turn Off and Turn On Procedures       |
| 6.2.6         | G&N Operational Test                          |
| 6.2.7         | Gimbal Friction Test                          |
| 6.2.8         | G&N Panel Brightness & Lamp Test              |
| 6.2.9         | Semi-Automatic Mode Control Test              |
| 6.2.10        | Zero Optics Test                              |
| 6.2.11        | Optics Coordinate Transformation Control Test |
| 6.2.12        | Optics Function Test - VAB and PAD            |
| 6.2.13        | Optics Slew Rate Test                         |
| 6.2.14        | Stabilization Loop Step Response Test         |
| 6.2.15        | IRIG Scale Factor Test                        |
| 6.2.16        | IMU Performance Test                          |
| 6.2.17        | Fine Alignment Test EXT-NB-IMU                |
| 6.2.18        | Gyrocompassing Test                           |
| 6.2.19        | Voltage Margin Test                           |
| 6.2.20        | S/C Control & Display Test                    |

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6.2.1.3.8.6 With the eyepiece in the Eyepiece Storage Unit, check the eyepiece surface temperature at the quick disconnect flange using an L&N #6693 Temperature Potentiometer, or a similar type thermocouple probe meter. Record both the ESU ambient and eyepiece surface temperatures. Verify that the eyepiece surface temperature is between 5 and 30 degrees F. above the ambient temperature.

6.2.1.3.9 Deleted.

6.2.1.3.10 Initiate CMC self-check by entering the following sequence into the K-start:

- a. VERB 21 NOUN 27, ENTER
- b. 77777, ENTER
- c. VERB 15 NOUN 01, ENTER
- d. 1344, ENTER

6.2.1.3.10.1 Monitor until R2 (SCOUNT +1) increments twice. If an error is detected the PROGRAM ALARM lamp on the DSKY's shall light.

6.2.1.3.10.2 Terminate the monitor routine by entering the following into the DSKY.  
VERB 34, ENTER

6.2.1.3.10.3 Enter the following into the K-144::

- a. VERB 21
- b. NOUN 27, press ENTER pushbutton
- c. 00000, press ENTER pushbutton

6.2.2 CMC Operational Test

NOTE: Verify that IMU STANDBY power (including CMC operate power) is applied. IMU OPERATE Power is not applied. (G&N IMU HTR MN A and MN B breakers engaged, Computer MN A and MN B breakers engaged, IMU MN A and MN B breakers disengaged, G/N Power-IMU switch on LEB Lighting Control Panel in OFF Position).

6.2.2.1 Using the LEB CMC DSKY, enter the following sequence of data into the CMC to initiate the DSKY check. Press the ENTER pushbutton after each entry denoted by E).

VERB 34, E Press RESET

VERB 21 NOUN 27, E

77744, E

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- 6.2.2.3.2(Cont) j. OPR ERROR Flashing
- k. COMPACTY (only momentarily ON)
- l. PROGRAM 88
- m. VERB 88 NOUN 88 flashing
- n. +88888 in R1, R2 and R3
- o. PONCS. CMC, ISS WARNING lights (CMC shall remain illuminated for 15±5 seconds).
- After indications a. through m. go out, +88888 shall remain in R1, R2, R3.
- 6.2.2.4 DSKY Pushbutton Check
- 6.2.2.4.1 Enter the following sequence into the LEB CMC DSKY. Press the ENTER pushbutton after each entry (denoted by E).
- a. VERB 25 NOUN 01, E  
b. 02100, E  
c. +00123, E  
d. -00456, E  
e. -00789, E
- 6.2.2.4.2 The LEB CMC DSKY shall indicate +00123 in R1, -00456 in R2, and -00789 in R3.
- 6.2.2.4.3 Enter VERB 06, NOUN 01 into the LEB CMC DSKY. Press the ENTER pushbutton.
- 6.2.2.4.4 Enter 02100 into LEB CMC DSKY. Press the ENTER pushbutton. The LEB CMC DSKY shall indicate 00024 in R1, 77664 in R2, and 77676 in R3. Verify.
- 6.2.2.4.5 Enter the following sequence into the LEB CMC DSKY.
- a. VERB 21 NOUN 01, ENTER  
b. 02100, ENTER  
c. +00123, DO NOT press ENTER
- 6.2.2.4.5.1 Press the CLEAR pushbutton. R1 shall clear.
- 6.2.2.4.6 Enter VERB 06 NOUN 70 into the LEB CMC DSKY. Press the ENTER pushbutton. The operator Error Light shall light.
- 6.2.2.4.6.1 Press the RESET pushbutton. The Operator Error light shall extinguish.

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- 6.2.2.5.8 Set the UP TLM switch on the MAIN DISPLAY Panel to BLOCK. Verify that the BLOCK UPLINK discrete is ON.
- 6.2.2.5.9 On K-148 insert VERB. Verify VERB indication on the DISKY and CRT does not change.
- 6.2.2.5.10 Set the UP TLM switch on the MAIN DISPLAY Panel to ACCEPT. Verify that the BLOCK UPLINK discrete is OFF. Remove the Block Uplink Override R-START.
- 6.2.2.5.11 On K-148 insert VERB 36. Press the ENTER pushbutton.
- 6.2.2.6 Deleted
- 6.2.2.7 Parity Fail Test
- 6.2.2.7.1 Enter the following into the K-148. Press the ENTER pushbutton after each entry.
  - a. Deleted.
  - b. Deleted.
  - c. VERB 24 NOUN 02, ENTER
  - d. 02100 ENTER
  - e. 33777, ENTER
  - f. 04544, ENTER
  - g. VERB 25 NOUN 26, ENTER
  - h. 04006, ENTER
  - j. 01500 ENTER
  - k. 00004 ENTER
  - m. VERB 30, ENTER

The RESTART lamps on the MDC & LEB DISKY's shall illuminate. The PGNS caution lamps on the MDC & LEB annunciator panels shall illuminate.
- 6.2.2.7.2 Press the ERROR RESET pushbutton on the K-148. The RESTART & PGNS caution lamps shall extinguish.
- 6.2.2.7.3 Enter VERB 36, into the K-148. Press the ENTER pushbutton.

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- 6.2.3.1.5 Perform the following sequence:
- Turn on the IMU MN A and MN B circuit breakers on the Right Hand Circuit Breaker Panel (breakers pushed in).
  - Start Analog Recorders.
  - Place G/N Power - IMU switch on the LEB Lighting Control Panel to IMU (switch toggle up).
- 6.2.3.1.6 Immediately begin monitoring the following measurements.
- The IMU Operate Power is  $\pm 28.8 \pm 8$  VDC (CG 1500). Verify on CRT.
  - On the recorders, verify that oscillations are not sustained and that a null is achieved within 10 seconds of power application in 6.2.3.1.5 on the following measurements:  
CG 2112, RG IX Resolver Output Sin  
CG 2142, MG IX Resolver Output Sin  
CG 2172, OG IX Resolver Output Sin
  - Deleted.
  - On the CRT, verify the absence of the  $\pm 120$  VDC PIPA supply (CG 1040) for a period of  $90 \pm 10$  seconds following power application in 6.2.3.1.5. Verify PIPA fail discrete is present during this period. After approximately 100 seconds, the voltage shall read  $\pm 120 \pm 8$  Vdc.
  - Stop the analog recorders.
- 6.2.3.1.7 Insure that the following alarm lamps are not lighted on G&N LEB Display Panel.
- CMC Warning
  - ISS Warning
  - PGNS Caution
- 6.2.3.1.8 Verify that the PROGRAM ALARM lamp on the DSKY's does not light.
- 6.2.3.1.9 The OG, IG, and MG CDU angles shall be approximately zero. Verify on CRT.
- 6.2.3.1.10 Enter the following into K-148:
- VERB 41 NOUN 20, ENTER
  - +00000, ENTER
  - +00000, ENTER
  - +00000, ENTER

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6.2.3.1.11 Verify that the following secondary power supply voltages are not flashing on the CRT display.

SECONDARY POWER SUPPLY VOLTAGES

| <u>Meas. No.</u> | <u>Signal</u>              |
|------------------|----------------------------|
| 1. CG 1040       | +120 VDC PIPA SUPPLY       |
| 2. CG 1051       | +20 VDC PIPA SUPPLY        |
| 3. CG 1052       | -20 VDC PIPA SUPPLY        |
| 4. CG 1070       | +4 VDC CDU SUPPLY          |
| 5. CG 1100       | -28 VDC ELECTRONICS        |
| 6. CG 1020       | +14 VDC CMC SUPPLY         |
| 7. CG 1080       | +4 VDC CMC SUPPLY          |
| 8. CG 1201       | IMU 28V 800 CPS 1 pct 0 ph |
| 9. CG 1202       | IMU 28V 800 CPS 5 pct ph A |
| 10. CG 1203      | IMU 28V 800 CPS 5 pct ph B |
| 11. CG 1331      | 3.2KC 28V SUPPLY           |
| 12. CG 1110      | 2.5 VDC TM BIAS            |

6.2.3.1.12 The IMU Platform should not be moved during the Temperature Control Test. 15 minutes after the application of IMU OPERATE power record PIPA TEMP (CG 2300) displayed on the CRT.

6.2.3.1.14 1 hour after the application of IMU OPERATE power monitor and record PIPA TEMP (CG 2300) every 5 minutes for 1 hour. Verify that each reading does not deviate from the average of each signal by more than 0.1°F.

6.2.3.1.15 When 2 hours have elapsed since the application of IMU OPERATE power record PIPA TEMP. PIPA TEMP shall be 130.5±1.5°F. PIPA TEMP shall be within 0.5°F of that recorded in 6.2.3.1.12 and 6.2.1.3.8.4.

6.2.3.2 Optics Power ON

6.2.3.2.1 Optics power shall be applied by actuating the G&N OPTICS MN A and OPTICS MN B breakers on the Right Hand Circuit Breaker Panel (breakers pushed in), and placing G/N Power - OPTICS switch on the LEB Lighting Control Panel to ON.

6.2.3.2.2 OPTICS +28 VDC discrete shall be issued (CG 1533). Verify by observing that the OPTICS lamp on Event Module is illuminated. Verify that the +28 VDC OPTX OPERATE BUS (CG 1530) is +28.8±3 VDC. Record the indication on the CRT.

6.2.3.2.3 Verify the following secondary power supply voltages on the CRT are not flashing:

|         |                             |
|---------|-----------------------------|
| CG 1211 | OPTX 28V 800 CPS 1 pct 0 ph |
| CG 1212 | OPTX 800 CPS 5 pct-90 ph    |

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- 6.2.5.2.10 b. On the meter modules verify that oscillations are not sustained and that a null is achieved within 10 seconds of power application on the following measurements:

|         |                           |
|---------|---------------------------|
| CG 2112 | IG 1X Resolver Output Sin |
| CG 2142 | MG 1X Resolver Output Sin |
| CG 2172 | OG 1X Resolver Output Sin |

- c. On the CRT verify the absence of the +120 VDC PIPA Supply (CG 1040) for a period of 90±10 seconds following power application. After approximately 100 seconds, the voltage shall read +120±6 VDC.

- 6.2.5.2.11 Verify that the PROGRAM ALARM lamp on the DSKY's does not light.
- 6.2.5.2.12 Enter and verify VERB 40, NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.5.2.13 Enter and verify VERB 41, NOUN 20 into K148. Press the ENTER pushbutton to advance the System to the Coarse Align mode. The VERB-NOUN display on the CRT shall flash and indicate 21-22.
- 6.2.5.2.14 Enter and verify +00000 into K148 three times, pressing the ENTER pushbutton on the K-148 after each entry.
- 6.2.5.2.15 Set the G&N OPTICS MNA and MN B circuit breakers on the Right Hand Circuit breaker panel to the ON position (breaker pushed in).
- 6.2.5.2.16 Verify that the CRT indications of the signals in table below are not flashing.

Secondary Power Supply Voltages

| Measurement Number | Signal                     |
|--------------------|----------------------------|
| 1 CG 1040          | +120 VDC PIPA SUPPLY       |
| 2 CG 1051          | +20 VDC PIPA SUPPLY        |
| 3 CG 1052          | -20 VDC PIPA SUPPLY        |
| 4 CG 1070          | +4 VDC CDU SUPPLY          |
| 5 CG 1100          | -28 VDC ELECTRONICS        |
| 6 CG 1020          | +14 VDC CMC SUPPLY         |
| 7 CG 1030          | + VDC CMC SUPPLY           |
| 8 CG 1201          | IMU 28V 800 CPS 1 pct 0 ph |
| 9 CG 1202          | IMU 28V 800 CPS 5 pct ph A |
| 10 CG 1203         | IMU 28V 800 CPS 5 pct ph B |
| 11 CG 1331         | 3.2 KC 28V SUPPLY          |
| 12 CG 1110         | 2.5 VDC TM BIAS            |



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- 6.2.7.2.2 Enter the following sequence into the K-148, pushing the ENTER pushbutton after each entry (+360 IG torquing).
- a. VERB 21 NOUN 01 ENTR
  - b. 02500 ENTR
  - c. 00000 ENTR
  - d. NOUN 15 ENTR
  - e. 00000 ENTR/ENTR
  - f. 40000 ENTR/ENTR
  - g. 40034 ENTR/ENTR
  - h. 00000 ENTR/ENTR
  - i. 00000 ENTR
- 6.2.7.2.3 Enter the following sequence into K 148:
- a. VERB 42, press ENTER
  - b. VERB 33, press ENTER
- 6.2.7.2.4 Start analog recorders.
- 6.2.7.2.5 Verify that IG Servo Error Quadrature (CG 2108) is 0.0±1.2V rms. Observe measurement CG 2112, IG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes) stop the recorders.
- 6.2.7.2.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- VERB 40 NOUN 20 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR  
VERB 41 NOUN 20 ENTR  
+17000 ENTR  
+17000 ENTR  
+17000 ENTR  
VERB 41 NOUN 20 ENTR  
+27000 ENTR  
+27000 ENTR  
+27000 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.2.7.2.7 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.2.8 Enter the following sequence into the K-148. Push the ENTER pushbutton after each entry (-360° IG torquing):
- a. VERB 24 NOUN 01 ENTER
  - b. 02502, ENTER
  - c. 37777, ENTER
  - d. 37743, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.

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- 6.2.7.2.9 Enter the following sequence into K-148:
- VERB 42, press ENTR
  - VERB 33, press ENTR
- 6.2.7.2.10 Start analog recorders.
- 6.2.7.2.11 Observe measurement CG 2112, IG 1X Resolver Output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.
- 6.2.7.2.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- VERB 40 NOUN 20 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR  
VERB 41 NOUN 20 ENTR  
+17000 ENTR  
+17000 ENTR  
+17000 ENTR  
VERB 41 NOUN 20 ENTR  
+27000 ENTR  
+27000 ENTR  
+27000 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.2.7.2.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.3 Outer Gimbal Friction Test.
- 6.2.7.3.1 Set up the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):
- CG 2160 OG TORQUE MOTOR CURRENT
  - CG 2177 OGA SERVO ERROR IN PHASE
  - CG 2172 OG 1X RESOLVER OUTPUT SIN
  - CG 2173 OG 1X RESOLVER OUTPUT COS
  - CG 2260 OGA CDU FINE ERROR
  - CG 2281 OGA CDU Coarse Error
- 6.2.7.3.2 Enter the following sequence into the K-148. Pushing the ENTER pushbutton after each entry (+360° OG torquing):
- VERB 24 NOUN 01 ENTR
  - 02500, ENTR
  - 40000, ENTR
  - 40034, ENTR
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.

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- 6.2.7.3.3 Enter the following sequence into K-148:  
a. VERB 42, press ENTR  
b. VERB 33, press ENTR
- 6.2.7.3.4 Start analog recorders
- 6.2.7.3.5 Observe measurement CG 2172, OG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.
- 6.2.7.3.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.  
VERB 40 NOUN 20 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR  
VERB 41 NOUN 20 ENTR  
+17000 ENTR  
+17000 ENTR  
+17000 ENTR  
VERB 41 NOUN 20 ENTR  
+27000 ENTR  
+27000 ENTR  
+27000 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.2.7.3.7 Verify that OG Servo Error Quadrature (CG 2168) is  $0.01 \pm 1.2V$  rms. Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.3.8 Enter the following sequence into the K-148. Push the ENTER pushbutton after each entry (-360° OG torquing):  
a. VERB 24 NOUN 01, ENTER  
b. 02500, ENTER  
c. 37777, ENTER  
d. 37743, ENTER  
Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.3.9 Enter the following sequence into K-148:  
a. VERB 42, press ENTER  
b. VERB 33, press ENTER
- 6.2.7.3.10 Start analog recorders.
- 6.2.7.3.11 Observe measurement CG 2172, OG 1X resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorder.

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- 6.2.7.3.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-148:
- ```

VERB 40 NOUN 20 ENTR
VERB 41 NOUN 20 ENTR
+00000      ENTR
+00000      ENTR
+00000      ENTR
VERB 41 NOUN 20 ENTR
+17000      ENTR
+17000      ENTR
+17000      ENTR
VERB 41 NOUN 20 ENTR
+27000      ENTR
+27000      ENTR
+27000      ENTR
VERB 41 NOUN 20 ENTR
+00000      ENTR
+00000      ENTR
-06750      ENTR

```
- 6.2.7.3.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = -06750. Wait 30 seconds before proceeding.
- 6.2.7.4 Middle Gimbal Friction Test.
- 6.2.7.4.1 Set up the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):
- CG 2150 MG TORQUE MOTOR CURRENT
 - CG 2147 MGA SERVO ERROR IN PHASE
 - CG 2142 MG 1X RESOLVER OUTPUT SIN
 - CG 2143 MG 1X RESOLVER OUTPUT COS
 - CG 2250 MGA CDU FINE ERROR
 - CG 2251 MGA CDU Coarse Error
- 6.2.7.4.2 Enter the following sequence into the K-148. Push the ENTER pushbutton after each entry (+135° MG torquing):
- VERB 24, NOUN 01, ENTER
 - 02504, ENTER
 - 63777, ENTER
 - 77777, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.4.3 Enter the following sequence in the K-148:
- VERB 42, press ENTER
 - VERB 33, press ENTER
- 6.2.7.4.4 Start the analog recorder.
- 6.2.7.4.5 Verify that MG Servo Error Quadrature (CG 2138) is 0.041.2V rms. Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs (approximately 5 minutes), stop the recorders.

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- 6.2.7.4.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- VERB 40 NOUN 20 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENI4
VERB 41 NOUN 20 ENTR
+17000 ENTR
+17000 ENTR
+17000 ENTR
VERB 41 NOUN 20 ENTR
+27000 ENTR
+27000 ENTR
+27000 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+06750 ENTR
- 6.2.7.4.7 Enter the following sequence into the K-148. Push ENTER pushbutton after each entry (-135° MG torquing):
- VERB 24 NOUN 01, ENTER
 - 02504, ENTER
 - 14000, ENTER
 - 00000, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.4.8 Enter the following sequence in the K-148.
- VERB 42, press ENTER
 - VERB 33, press ENTER
- 6.2.7.4.9 Start analog recorders.
- 6.2.7.4.10 Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When the steady-state condition occurs (approximately 5 minutes), stop the recorders.
- 6.2.7.4.11 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- VERB 40 NOUN 20, press ENTER
 - VERB 41 NOUN 20, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER
 - +00000, press ENTER

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- 6.2.7.5 Examine the traces of the recorded measurements for all six phases of this test to detect any sharp discontinuities. Disregard transients of 0.5 second duration or less on the Gimbal Torque motor current traces, disregard transients on the CDU fine error measurement traces. The Gimbal Torque motor currents shall not exceed 0.125 ampere. The CDU Fine Error measurements shall not exceed ± 70 mv rms. The CDU Coarse Error measurement shall not exceed ± 680 mv rms.
- 6.2.8 G&N Panel Brightness and Lamp Test
- 6.2.8.1 Proceed with this test if 6.2.5.2 or 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2 before proceeding with this test.
- 6.2.8.2 Rotate the RETICLE BRIGHTNESS thumbwheel on the Control Indicator Panel and verify the capability to control the illumination of the following lamps:
- a. SCT reticles
 - b. SXT reticles
 - c. Telescope Panel Angle Counters
- 6.2.8.3 Turn on LIGHTS-INTEGRAL control on Left Hand Circuit Breaker panel and LEB Lighting Control Panel.
- 6.2.8.4 Adjust the brightness controls on the LEB Lighting Control Panel and Left Hand Circuit Breaker Panel from minimum brightness to maximum brightness. Verify the operation of the G&N Indicator Control Panel lamps.
- 6.2.8.4.1 Re-adjust brightness controls for minimum acceptable lighting. Turn off LIGHTS-INTEGRAL control on Left Hand Circuit Breaker panel and LEB Lighting Control Panel.
- 6.2.8.5 Push and hold the CONDITION LAMPS switch on the G&N Indicator Control Panel to TEST. Verify the illumination of the following lamps:
- a. STAR ACQ
 - b. MASTER ALARM lamp
- 6.2.8.6 Set the CONDITION LAMPS switch to ON. Lamps a and b in 6.2.8.5 shall extinguish.
- 6.2.9 Semi-Automatic Moding Check
- Proceed with this test if 6.2.3 has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 before proceeding with this test.
- 6.2.9.1 Test Initiation
- 6.2.9.1.1 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify OPTX BUS, 28V 800W1% and 5% Power Supplies.

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6.2.15.6 VERB 06 NOUN 41 shall flash on CRT and the following displayed in R1 and R2:

R1 = xxxxxx (some Nav. Base azimuth)
R2 = xxxxxx (some test site latitude; see table below).

6.2.15.7 If the values displayed in R1 and R2 are correct, proceed with test, if not perform the following sequence:

- a. To correct T1, on the K-148 enter VERB 21, press ENTER push-button, xxx.x, press ENTER (xxx.x is correct nav. base azimuth).
- b. To correct R2, on the K-148 enter VERB 22, press ENTER push-button, xxx.xxx, press ENTER (obtain correct site latitude from table below).

Verify that the values in R1 and R2 are correct.

| SITE | LATITUDE |
|------------|----------|
| NAA | +33.921 |
| MSC | +29.558 |
| KSC MSO | +28.523 |
| KSC VAB | +28.585 |
| KSC PAD 39 | +28.607 |

6.2.15.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00001 ENTR

NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.8.

6.2.15.9 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+X IRIG Scale Factor error in part per million, Position +00001).

6.2.15.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00002 ENTR

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6.2.16 IMU Performance Test

6.2.16.1 Proceed with this test if the Operate Power On Test of 6.2.3 or the Turn On Procedure of 6.2.5.2 has been completed and system operation has not been interrupted. If the system operation has been interrupted, perform Turn On Procedure of 6.2.5.2 before proceeding with this test.

6.2.16.2 Verify that the IMU Operate Power has been applied for at least one hour.

6.2.16.3 On K-148, enter the following:

VERB 92 ENTR

6.2.16.4 Enter 00001 into K-148. Press the ENTER pushbutton.

6.2.16.5 On the CRT DSKY display VERB 06 NOUN 41 shall flash. Verify R1 (Nav Base Azimuth) and R2 (Site Latitude) are correct.

6.2.16.6 If values for R1 and R2 are correct, proceed to next step. If values for R1 and R2 are incorrect, enter the following sequence into K-148.

VERB 24 ENTR
+XXX,XX ENTR (Correct navigation base azimuth ± 0.50 deg)
+XX,XXX ENTR (Correct site latitude from table below)

Verify values in R1 and R2 are correct.

| Location | Latitude |
|----------|----------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC-MSO | +28.523 |
| KSC-VAB | +28.585 |
| KSC-PAD | +28.607 |

6.2.16.7 On K-148, enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.8 On CRT DSKY display, verify R1 = +00900 (Time), R2 = +00000 (Test Index No.) and R3 = +00012 (Test Position). If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00012 ENTR (Test Position Entry)

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6.2.16.67 On K-148 enter the following sequence:
VERB 33 ENTR

6.2.16.68 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.

6.2.16.69 On K-148, enter the following sequence:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.70 On CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00013.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00013 ENTR (Test Position Entry)

6.2.16.71 On K-148, enter the following sequence:
VERB 33 ENTR

6.2.16.72 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.73 Terminate this test by entering the following into K-148:
VERB 36 ENTR

6.2.16.74 On K-148 enter the following sequence:
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

6.2.16.75

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6.2.16.75

Calculations

Position No. as
Displayed in R3

Quantity Being Measured

| | |
|--------|--|
| +00001 | +NBDY + ADOAY +X PIPA G |
| +00002 | +NBDZ - ADOAZ -X PIPA G -NBDX + ADIAX |
| +00003 | -NBDX - ADOAX +Z PIPA G |
| +00004 | +NBDY + ADSRAY -Z PIPA G +NBDZ + ADIAZ |
| +00005 | +Y PIPA G |
| +00006 | -Y PIPA G |
| +00007 | -NBDX + .707 (ADSRAX - ADOAX) |
| +00008 | -.707 (NBDZ + NBDY) +.5 (ADIAZ - ADIAY) +.5 (ADSRAY + ADSRAZ) |
| +00009 | -NBDZ + .707 (ADSRAX - ADOAZ) |
| +00010 | .707 (NBDY - NBDX) +.5 (ADIAZ - ADIAX) +.5 (ADSRAX) + .5 (ADOAY) |
| +00011 | +NBDX - ADOAX |
| +00012 | +NBDY - ADOAY |
| +00013 | +NBDZ + ADOAZ |

6.2.16.75.2.2 Perform the following calculations for position 5.

$$G'_5 = \frac{G_5}{\cos \theta_{y_5}}$$

where:

G_5 = Measured acceleration term (line 11)

G'_5 = Corrected acceleration term

$\cos \theta_{y_5} = 1 - \frac{\theta_{y_5}^2}{2}$ for small angles

$$\theta_{y_5} = \sqrt{\theta_{x5}^2 + \theta_{z5}^2}$$

and

$$\theta_{x5} = (\Delta V_{x5} - \Delta V_{x \text{ Bias}}) (S.F._x) / (\Delta T)(\text{local } g)$$

$$\theta_{z5} = (\Delta V_{z5} - \Delta V_{z \text{ Bias}}) (S.F._z) / (\Delta T)(\text{local } g)$$

and

$$\Delta V_{x \text{ Bias}} = (X \text{ PIPA Bias})(\Delta T)/S.F._x$$

$$\Delta V_{z \text{ Bias}} = (Z \text{ PIPA Bias})(\Delta T)/S.F._z$$

6.2.16.75.2.3 Perform the following calculations for position 6.

$$G'_6 = \frac{G_6}{\cos \theta_{y_6}}$$

where:

G_6 = Measured acceleration term (line 12)

G'_6 = Corrected acceleration term

$\cos \theta_{y_6} = 1 - \frac{\theta_{y_6}^2}{2}$ for small angles

6.2.16.17.2.3
(continued)

$$\sigma_{y_6} = \sqrt{\sigma_{x_6}^2 + \sigma_{z_6}^2}$$

and:

$$\sigma_{x_6} = (\Delta V_{x_6} - \Delta V_{x \text{ Bias}})(S.F._x) / (\Delta T) \text{ (local g)}$$

$$\sigma_{z_6} = (\Delta V_{z_6} - \Delta V_{z \text{ Bias}})(S.F._z) / (\Delta T) \text{ (local g)}$$

and:

$$\Delta V_{x \text{ Bias}} = (X \text{ PIPA Bias}) (\Delta T) / S.F._x$$

$$\Delta V_{z \text{ Bias}} = (Z \text{ PIPA Bias}) (\Delta T) / S.F._z$$

6.2.16.75.2.4 Compute the PIPA Scale Factor error in parts per million and record in Table X₁.

$$a. \text{ PIPA S.F. Error} = \left[\frac{2 \text{ local g}}{+PIPA G - (-PIPA G)} - 1.000000 \right] 10^6$$

$$b. \text{ X PIPA S.F. Error} = \left[\frac{2 \text{ local g}}{\text{line 2} - \text{line 4}} - 1.000000 \right] 10^6$$

$$c. \text{ Y PIPA S.F. Error} = \left[\frac{2 \text{ local g}}{G'_y - G'_x} - 1.000000 \right] 10^6$$

$$d. \text{ Z PIPA S.F. Error} = \left[\frac{2 \text{ local g}}{\text{line 7} - \text{line 9}} - 1.000000 \right] 10^6$$

The PIPA S.F. Error shall not exceed ±1000 PPM

Local Gravity Values

| Location | Local Gravity (cm/sec ²) |
|----------|--------------------------------------|
| NAA | 979.56 |
| MSC | 979.29 |
| KSC | 979.24 |

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- 6.2.17 EXT-NB-Fine Alignment Test
- 6.2.17.1 Deleted
- 6.2.17.2 The G&N shall have had OPERATE power applied for a minimum of 1 hour.
- 6.2.17.3 Set the G/N POWER-OPTICS switch to OPTICS. Verify that +28 VDC OPTICS OPERATE BUS (CG 1530) is +28.0±3.0 VDC. Verify that the OPTX 28V 800 cps 1% 0° ph (CG 1211) and OPTX 28V 800 cps 5% -90° ph (CG 1212) are not flashing on the CRT.
- 6.2.17.4 Deleted.
- 6.2.17.5 CAUTION: See Paragraph 5.1.2.11 before proceeding.
On the G&N Indicator Control Panel set the following switches to the position indicated.
- a. OPTICS TEL TRUN to SLAVE to EXT
 - b. OPTICS COUPLING to DIRECT
 - c. OPTICS SPEED to LO
 - d. OPTICS MODE to MAN
 - e. OPTICS ZERO to ZERO
- 6.2.17.6 Deleted.
- 6.2.17.7 Deleted
- 6.2.17.8 Initiate the test by entering the following sequence into the LEB DSKY.
- a. VERB 92, ENTER
 - b. 90000, ENTER
- 6.2.17.9 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data is display in R1 and R2 on the DSKY.
- a. R1 = +13500
 - b. R2 = +xx.xxx (Site Latitude from table below)

| <u>SITE</u> | <u>LATITUDE</u> |
|-------------|-----------------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC MBO | +28.523 |
| KSC VAB | +28.565 |
| KSC PAD 39 | +28.607 |

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- 6.2.17.10 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If the value displayed is other than +13500 in R1 and the correct Site Latitude in R2, correct the data by entering the following sequence into the DSKY.
- VERB 21, ENTER
 - +13500, ENTER
 - VERB 22, ENTER
 - +xx.xxx, ENTER (+xx.xxx = Site Latitude from table above)
 - VERB 33, ENTER
- 6.2.7.11 Observe VERB 25 NOUN 97 flashing on the DSKY. Enter the following sequence into the DSKY.
- +00001, ENTER (Position Number)
 - +00000, ENTER
 - +00001, ENTER
- 6.2.17.12 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- R1 = +xxx.xx (Y_{NB} Azimuth)
 - R2 = +xx.xxx (Y_{NB} Elevation)
 - R3 = 00001
- 6.2.17.13 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct Y_{NB} azimuth and elevation, correct the data by entering the following sequence into the DSKY.
- VERB 24, ENTER
 - +xxx.xxx+002.00 degrees, ENTER (Y_{NB} Azimuth)
 - +xx.xxx+02.000 degrees, ENTER (Y_{NB} Elevation)
 - VERB 33, ENTER
- 6.2.17.14 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- R1 = +xxx.xx (Z_{NB} Azimuth)
 - R2 = +xx.xxx (Z_{NB} Elevation)
 - R3 = 00002
- 6.2.17.15 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct Z_{NB} azimuth and elevation, correct the data by entering the following sequence into the DSKY.
- VERB 24, ENTER
 - +xxx.xxx+002.00 degrees, ENTER (Z_{NB} Azimuth)
 - +xx.xxx+02.000 degrees, ENTER (Z_{NB} Elevation)
 - VERB 33, ENTER

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- 6.2.17.23 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement of the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.24 Using the Optics Hand Controller, align the SXT S&LOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- NOTE: The following two MARKS must be performed as quickly as possible. In no case shall the time between the first and second MARK exceed two minutes.
- 6.2.17.25 After 20 seconds observe the DSKY for VERB 51 and NOUN 70 flashing and R1 = 00001. Set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.
- 6.2.17.26 Using the Optics Hand Controller, align the SXT S&LOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.27 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement to the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.28 Using the Optics Hand Controller, align the SXT S&LOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.29 In approximately 7 minutes VERB 06 NOUN 96 shall flash on the DSKY and the test results shall be displayed. R1 and R2 on the DSKY shall display the misalignment of one of the horizontal PIPA's in arc seconds (R1 = whole, R2 = fractional). Record R1 and R2. (See Table IV for PIPA displayed.)
- 6.2.17.30 Enter VERB 33 ENTER into the DSKY. When VERB 06 NOUN 96 flashes R1 and R2 on the DSKY shall display the misalignment of the second horizontal PIPA in arc seconds (R1 whole, R2 fractional). (See Table IV for PIPA displayed). Record R1 and R2.

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- 6.2.17.31 Enter VERB 34 ENTER into the DSKY to terminate the test. Wait 5 seconds.
- 6.2.17.32 Repeat steps 6.2.17.4 and 6.2.17.6 through 6.2.17.31 substituting No.00002 in 6.2.17.11.a.
- 6.2.17.33 Enter the following sequence into the DSKY:
- VERB 34, ENTER
 - VERB 41 NOUN 20, ENTER
 - +00000, ENTER
 - +00000, ENTER
 - +00000, ENTER
- 6.2.17.34 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.

Table IV. DISPLAY CONDITIONS AT TEST COMPLETION

| Position | SM Orientation | | | Horizontal Misalignment Component | |
|----------|-----------------|-----------------|-----------------|-----------------------------------|-----------------|
| | X _{SM} | Y _{SM} | Z _{SM} | 6.2.17.29 | 6.2.17.30 |
| 1. | UP | SW | SE | Y _{SM} | Z _{SM} |
| 2. | SE | SW | DN | X _{SM} | Y _{SM} |
| 3.* | SE | UP | SW | X _{SM} | Z _{SM} |

* Position 3 is not run in the Spacecraft because of GEMBAL LOCK considerations.

6.2.17.35 Calculations

- 6.2.17.35.1
- Y_{SM} misalignment = () $R1.R2$
 - Z_{SM} misalignment = () $R1.R2$
 - X_{SM} misalignment = () $R1.R2$
 - Y_{SM} misalignment = () $R1.R2$

6.2.17.35.2 Enter the latest values from 6.2.16 IMU Performance Test.

- X PIPA bias = _____ cm/sec²
- Y PIPA bias = _____ cm/sec²
- Z PIPA bias = _____ cm/sec²
- $\theta_x = 210$ (X PIPA bias) = _____ arc sec.
- $\theta_y = 210$ (Y PIPA bias) = _____ arc sec.
- $\theta_z = 210$ (Z PIPA bias) = _____ arc sec.

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6.2.18.2
(Continued)

| | |
|-----------------|------|
| 01733 | ENTR |
| XXXXX (ADSRAY) | ENTR |
| | ENTR |
| 01734 | ENTR |
| XXXXX (ADSBRAZ) | ENTR |

6.2.18.3 Enter NB Azimuth and Site Latitude (from table below) and Launch Azimuth into the CMC using the following sequence:

| | | |
|---------|---------|-----------------------------------|
| VERB 21 | NOUN 01 | ENTR |
| 2506 | | ENTR (NB Azimuth) |
| XXXXX | | ENTR (fraction of a Rev Hi order) |
| | | ENTR |
| 2507 | | ENTR (NB Azimuth) |
| XXXXX | | ENTR (fraction of a Rev Lo order) |
| | | ENTR |
| 2510 | | ENTR (Site Latitude) |
| XXXXX | | ENTR (fraction of a Rev Hi order) |
| | | ENTR |
| 2511 | | ENTR (Site Latitude) |
| XXXXX | | ENTR (fraction of a Rev Lo order) |
| | | ENTR |
| 2755 | | ENTR (Launch Azimuth) |
| XXXXX | | ENTR (fraction of a Rev Hi order) |
| | | ENTR |
| 2756 | | ENTR (Launch Azimuth) |
| XXXXX | | ENTR (fraction of a Rev Lo order) |

| <u>Location</u> | <u>Latitude (Fraction of a Rev)</u> <u>Hi Order</u> | <u>Low Order</u> |
|-----------------|--|------------------|
| NAA | 03007 | 36671 |
| MSC | 02423 | 23341 |
| KSC MSO | 02423 | 04033 |
| KSC VAB | 02424 | 36151 |
| KSC PAD 39 | 02425 | 37327 |

6.2.18.4 Enter the following into the CMC:

VERB 37 ENTER, 01 ENTER

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- 6.2.18.5 When PROG display changes to 02, record time as T_0 .
- 6.2.18.6 Gyro Compassing Accuracy
- 6.2.18.6.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. After 120 minutes from T_0 , set the OPTICS ZERO switch on the G&N Indicator to ZERO. Record Inner, Middle and Outer Gimbal CDU readings every 5 minutes for the next 2 hours.
- 6.2.18.6.2 Enter VERB 65, ENTER into DSKY. Observe the PROGRAM display on the DSKY change to 03.
- 6.2.18.6.3 When VERB 06 NOUN 41 flashes on the DSKY, insure R1 and R2 display Target 1 azimuth and elevation.
- a. R1 = +XXX.XX (Target 1 azimuth)
 - b. R2 = +XX.XXX (Target 1 elevation)
 - c. R3 = 00001
- 6.2.18.6.4 Verify the data appearing in R1 and R2 and if correct, proceed. If not correct, perform the following sequence:
- a. VERB 24, ENTER
 - b. +XXX.XX, ENTER (Target 1 azimuth)
 - c. +XX.XXX, ENTER (Target 1 elevation)
- 6.2.18.6.5 After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY.
- 6.2.18.6.6 When VERB 06 NOUN 41 flashes on the DSKY, insure that R1 and R2 display Target 2 azimuth and elevation.
- a. R1 = XXX.XX (Target 2 azimuth)
 - b. R2 = XX.XXX (Target 2 elevation)
 - c. R3 = 00002.
- 6.2.18.6.7 Verify the data appearing in R1 and R2 and if correct, perform the following sequence:
- a. VERB 24, ENTER
 - b. +XXX.XX, ENTER (Target 2 azimuth)
 - c. +XX.XXX, ENTER (Target 2 elevation)

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- 6.2.19 CMC Voltage Margin Test
- 6.2.19.1 Verify that the G&N IMU NTR MNA & MNB circuit breakers are engaged, Computer NMA & NMB breakers are engaged, IMU MNA & MNB circuit breakers are not engaged, and the G&N Power - IMU switch on the LEB Lighting Control Panel is in the OFF position.
- 6.2.19.2 On the PSA Adapter Module set the INHIBIT VOLTAGE FAIL switch to ON.
- Caution:** During the performance of this test the +4 VDC CMC Power Supply shall not be operated at less than +2.5 VDC or greater than 5.2 VDC (CG 1030). The +14 VDC CMC Power Supply shall not be operated at less than +8.5 VDC or greater than +17.0 VDC (CG 1020). Rotate the LEB LTS NUMERICS SEL to approximately center position. Decrease to absolute minimum discernible lighting.
- Note:** The flashing indication of the CMC Power Supplies on CRT may be disregarded for this test. The charts in Table V may be used to determine approximate values for the "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.
- 6.2.19.3 Into R154 insert 0001. Verify and execute.
- 6.2.19.3.1 Into R153 insert 1100. Verify and execute.
- 6.2.19.4 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.5 Into C156 insert -050001234. Verify and execute. Verify on the CRT that GV0106 is between -4.0 and -6.0 VDC.
- 6.2.19.6 Into R154 insert 0111. Verify and execute.
- 6.2.19.7 Observe CG 1020, +14 VDC CMC Power Supply and CG 1030, +4 VDC CMC Power Supply, on the CRT. Repeat 6.2.19.3 through 6.2.19.6 adjusting each C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC and CG 1030 is +3.40 (+0.03 - 0.00) VDC.
- 6.2.19.8 Initiate CMC Self Check by inserting the following into K148:
- ERROR RESET
 - VERB 21 NOUN 27, ENTER
 - 77777, ENTER
- Wait 200 seconds

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- 6.2.19.9 Insure that the DSKY RESTART lamp and Program Alarm lamp does not light.
- 6.2.19.9.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.10 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify the RESTART lamp on the DSKY is lighted. Disregard other DSKY indications. If RESTART does not light, repeat 6.2.19.9. Verify CMC Warning masters alarm are lighted.
- 6.2.19.11 Set the INHIBIT VOLTAGE FAIL switch to ON. Insert the following into KI48:
 - a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- 6.2.19.12 Into R154 insert 00001. Verify and execute.
- 6.2.19.13 Into C156 insert +106001244. Verify and execute. Verify on the CRT that GV0116 is between +9.8 and +11.6 VDC.
- 6.2.19.14 Into R154 insert 0111. Verify and execute.
- 6.2.19.15 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.13 through 6.2.19.14 adjusting the C-Start entry until CG 1020 is 14.4 (+0.1, -0.0) VDC.
- 6.2.19.16 Press ERROR RESET on KI48. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.16.1 Into R154 insert 0011. Verify and execute.
- 6.2.19.17 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted.
- 6.2.19.18 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to ON. Into KI48 insert:
 - a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- 6.2.19.19 Into R154 insert 0001. Verify and execute.

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- 6.2.19.20 Into C156 enter +092001234. Verify and execute. Verify on the CRT that GV0106 is between +8.2 and +10.2 VDC.
- 6.2.19.21 Into R154 insert 0111. Verify and execute.
- 6.2.19.22 Observe CG 1030, +4 VDC CMC Power Supply on the CRT. Repeat 6.2.19.19 through 6.2.19.21 adjusting the C-Start entry until CG 1030 is +4.60 (+0.08, -0.08) VDC.
- 6.2.19.23 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.23.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.24 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Verify CMC Warning master alarms are lighted.
- 6.2.19.25 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to ON. Into K148 insert:
- a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- 6.2.19.26 Into R154 insert 0001. Verify and execute.
- 6.2.19.27 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.28 Into R154 insert 0111. Verify and execute.
- 6.2.19.29 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.26 through 6.2.19.28 adjusting the C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC.
- 6.2.19.30 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.30.1 Into R154 insert 0011. Verify and execute.

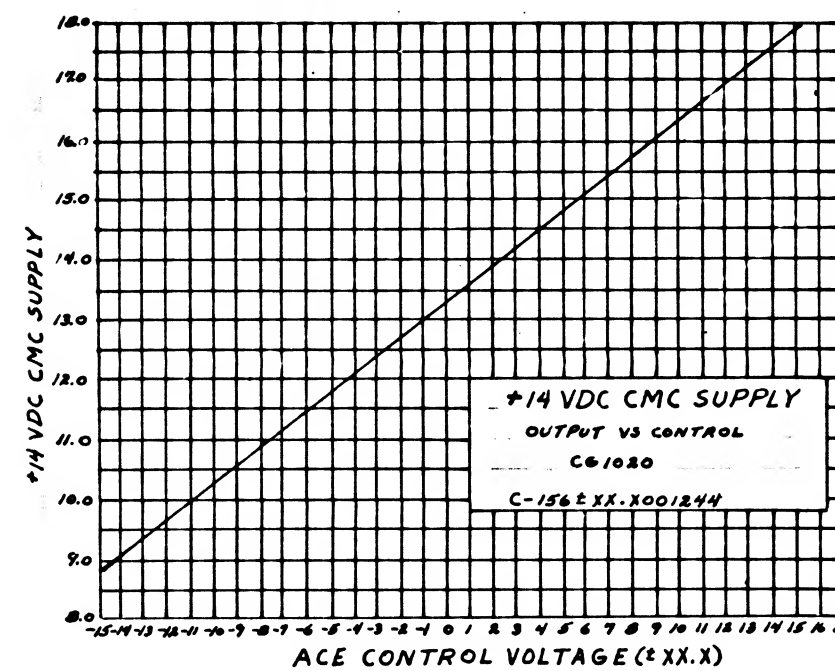
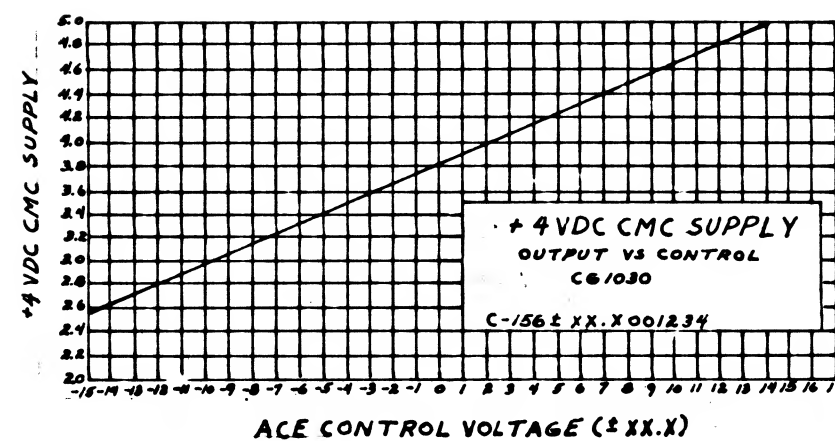


TABLE V

ADDENDUM I - Deleted

ADDENDUM II - Deleted

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- Change 5 Add new paragraph 6.1.1.8 as follows:
- From the on board tape recorder verify the presence of the following signals:
- a. VIB NB ROLL (CG 6001)
 - b. VIB NB PITCH (CG 6002)
 - c. VIB NB YAW (CG 6003)
- Change 6 Paragraph 6.2.1.3.8.5 add to the first sentence the following:
- "...PIPA TEMP (CG 2300) and IRIG TEMP (CG 2301) on the CRT."
- Add Paragraph 6.2.3.1.13 as follows:
- 6.2.3.1.13 "30 minutes after the application of IMU OPERATE power record IRIG TEMP (CG 2301) displayed on the CRT".
- Paragraph 6.2.3.1.14, add to the first sentence the following:
- "...PIPA TEMP (CG 2300) and IRIG TEMP (CG 2301) every..."
- Paragraph 6.2.3.1.15 change to read as follows:
- "When 2 hours have elapsed since the application of IMU OPERATE power record PIPA TEMP and IRIG TEMP. PIPA TEMP shall be $130.5^{\circ} \pm 1.5^{\circ} \text{F}$. IRIG TEMP shall be $135^{\circ} \pm 2.5^{\circ} \text{F}$. PIPA TEMP shall be within 0.5°F of that recorded in 6.2.3.1.12 and 6.2.1.3.8.4. IRIG TEMP shall be within 0.5°F of that recorded in 6.2.3.1.13".
- Paragraph 6.2.5.2.16, add measurement No. 13 to table as follows:
- "13 CG 2301 IRIG TEMPERATURE"
- Add Paragraph 6.2.1.3.8.4.1 as follows:
- 6.2.1.3.8.4.1 The IRIG TEMP on the CRT shall be monitored at 15 min, 1 hour, and 2 hours after 6.2.1.3.8.2 is executed to insure that the IRIG TEMP (CG 2301) is within ± 3.0 degrees of the PIPA Temperature.
- Change 7 Paragraph 6.1.1.6, add item "f" as follows:
- "f" The TRACKER switch on G&N Indicator Control Panel shall be set to OFF.

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- Change 17 Replace paragraph 6.2.17.20 with the following:
- 6.2.17.20 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN. Enter VERB 33, ENTER into the DSKY.
- Change 18 In Paragraphs 6.2.18.6.1, 6.2.18.6.10, 6.2.18.6.11 and 6.2.18.6.13, change the nomenclature of switches on the G&N Indicator as follows:
- 6.2.18.6.1 From: OPTICS ZERO switch
 To: OPTICS MODE switch
- 6.2.18.6.10 From: OPTICS SPEED switch
 To: CONTROLLER SPEED switch
- 6.2.18.6.11 From: OPTICS SPEED switch
 To: CONTROLLER SPEED switch
- 6.2.18.6.13 From: OPTICS ZERO switch
 To: OPTICS MODE switch
- Change 19 Replace paragraphs 6.2.20.3.2, 6.2.20.3.22, and 6.2.20.3.29 and replace with the following:
- 6.2.20.3.2 Set the OPTICS MODE selector on the Indicator Control panel to MAN.
- 6.2.20.3.22 Set the OPTICS CONTROLLER SPEED switch on the Indicator Control Panel to HI.
- 6.2.20.3.29 Set the OPTICS MODE switch on the Indicator Control panel to ZERO for 30 seconds then return to MAN.

APOLLO GAN Specification
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POST INSTALLATION CHECKOUT PROCESS
SPECIFICATION FOR THE APOLLO GUIDANCE &
NAVIGATION SYSTEM BLOCK II-KSC

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| 8/21/68 | H | 36709 | 4, 9, 11-15, 22, 24, 26, 33, 34, 43, 46-51, 75, 78, 85, 86, 88, 89, 97, 98, 100, 101, 104, 105, 108-110, 112, 126, 128 and 144. Specification now comprised of a total of 145 pages. | SB | WLS |
| 9/5/68 | J | 36790 | 9 | EA | WLS |
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This specification consists of page 1 to 144 inclusive.

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|-----------|----------|-------------------------|----------------------|--------------------|
| APPROVALS | NASA/MSC | W.S. Swingle 2/17/67 | E. Austin 2/17/67 | R.D. Petryk |
| | | | | D. A. Ziemer AC |

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POST INSTALLATION CHECKOUT PROCESS
 SPECIFICATION FOR THE APOLLO GUIDANCE &
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| Date | Revision Letter | TDRR No. | Pages Revised | Approvals | |
|---------|-----------------|----------|--|-----------|------|
| | | | | AC | NASA |
| 8/21/68 | H | 36709 | 4, 9, 11-15, 22, 24, 26, 33, 34, 43, 46-51, 75, 78, 85, 86, 88, 89, 97, 98, 100, 101, 104, 105, 108-110, 112, 126, 128 and 144. Specification now comprised of a total of 145 pages. | SB | WLS |
| 9/5/68 | J | 36790 | 9 | EA | WLS |
| 5/1/69 | K | 37571 | 79, 80 | EA | RJJ |

This specification consists of page 1 to 144 inclusive.

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|-----------|---------|--------------------------|----------------------|------------------------------------|
| APPROVALS | NASA/MS | W. S. Swingle 2/17/67 | E. Austin 2/17/67 | R. D. Petryk D. A. Ziemer AC |
| | | | | |

APOLLO G&N Specification
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- 6.2.16.9 On K-148, enter the following sequence:
VERB 33 ENTR
- 6.2.16.10 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.11 On K-148, enter the following sequence:
VERB 21 NOUN 01 ENTR
02552 ENTR
XXXXX ENTR (value of R2 from 6.2.16.10)
VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.12 On CRT DSKY displays, verify R1 = +00900, R2 = +00000, and R3 = +00002.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00002 ENTR (Test Position Entry)
- 6.2.16.13 On K-148, enter the following sequence:
VERB 33 ENTR
- 6.2.16.14 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.15 On K-148, enter the following sequence:
VERB 33 ENTR
- 6.2.16.16 In approximately 90 seconds VERB 06 NOUN 98 shall flash. From the CRT, record R1 and R2.
- 6.2.16.17 On K-148, enter the following sequence:
VERB 33 ENTR
- 6.2.16.18 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2. Record CRT CDU gimbal angle indications and time.
- 6.2.16.19 On K-148, enter the following sequence:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash

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- 6.2.16.20 On CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00011.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- | | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00011 | ENTR (Test Position Entry) |
- 6.2.16.21 On K-148, enter the following sequence:
- | | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.22 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.23 On K-148, enter the following sequence:
- | | |
|---------|-----------------------------------|
| VERB 21 | NOUN 01 ENTR |
| 02554 | ENTR |
| XXXXX | ENTR (value of R2 from 6.2.16.22) |
| VERB 34 | ENTR |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.24 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00004.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- | | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00004 | ENTR (Test Position Entry) |
- 6.2.16.25 On K-148, enter the following sequence:
- | | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.26 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.27 On K-148, enter the following sequence:
- | | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.28 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.
- 6.2.16.29 On K-148, enter the following sequence:
- | | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

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 ND1002348 L
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 Class A Release

POST INSTALLATION CHECKOUT PROCESS
 SPECIFICATION FOR THE APOLLO GUIDANCE &
 NAVIGATION SYSTEM BLOCK II-KSC

Record of Revisions

| Date | Revision Letter | TDRR No. | Pages Revised | Approvals | |
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| | | | | AC | NASA |
| 8/21/68 | H | 36709 | 4, 9, 11-15, 22, 24, 26, 33, 34, 43, 46-51, 75, 78, 85, 86, 88, 89, 97, 98, 100, 101, 104, 105, 108-110, 112, 126, 128 and 144. Specification now comprised of a total of 145 pages. | SB | WLS |
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This specification consists of page 1 to 144 inclusive.

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|-----------|---------|-------------------------|----------------------|--------------------|
| APPROVALS | NASA/MS | W.S. Swingle 2/17/67 | E. Austin 2/17/67 | R.D. Petryk |
| | | | | D. A. Ziemer AC |

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- 6.2.2.5.8 Set the UP TLM switch on the MAIN DISPLAY Panel to BLOCK. Verify that the BLOCK UPLINK discrete is ON.
- 6.2.2.5.9 On K-148 insert VERB. Verify VERB indication on the DSKY and CRT does not change.
- 6.2.2.5.10 Set the UP TLM switch on the MAIN DISPLAY Panel to ACCEPT. Verify that the BLOCK UPLINK discrete is OFF. Remove the Block Uplink Override R-START.
- 6.2.2.5.11 On K-148 insert VERB 36. Press the ENTER pushbutton.
- 6.2.2.6 Alarms and Interrupts Test
- 6.2.2.6.1 Verify K-START tape F08C109-K10545-00 Alarms and Interrupts Test is on the K-START tape reader.
- 6.2.2.6.2 Start the tape reader.
- 6.2.2.6.3 When the tape reader stops verify:
 - R1 = +08282
 - R2 = +10545
 - R3 = -00000
- 6.2.2.6.4 Start the tape reader.
- 6.2.2.6.5 When the tape reader stops verify:
 - R1 = 00100
- 6.2.2.7 Parity Fail Test
- 6.2.2.7.1 Start the tape reader.
- 6.2.2.7.2 When the tape reader stops verify:
 - (a) On the DSKY, the RESTART lamp is lit.
 - (b) The PGNS Caution lamp is lit.
- 6.2.2.7.3 On the DSKY, press the RSET pushbutton. Verify the RESTART and PGNS Caution lamps are not lit.
- 6.2.2.7.4 Start the tape reader.
- 6.2.2.7.5 When the tape reader stops verify:
 - R1 = 00101
- 6.2.2.7.6 Start the tape reader.

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| | |
|-----------|--|
| 6.2.2.7.7 | When the tape reader stops verify: R1 = 00200 |
| 6.2.2.8 | Rupt Lock Test |
| 6.2.2.8.1 | Start the tape reader. |
| 6.2.2.8.2 | When the tape reader stops verify: (a) On the DSKY, the RESTART and PROG Caution lamps are lit. (b) The PGNS Caution lamp is lit. |
| 6.2.2.8.3 | On the DSKY, press the RSET pushbutton. Verify the RESTART, PROG and PGNS Caution lamps are not lit. |
| 6.2.2.8.4 | Start the tape reader. |
| 6.2.2.8.5 | When the tape reader stops verify: R1 = 00201 |
| 6.2.2.8.6 | Start the tape reader. |
| 6.2.2.8.7 | When the tape reader stops verify: R1 = 00300 |
| 6.2.2.9 | TC Trap Test |
| 6.2.2.9.1 | Start the tape reader. |
| 6.2.2.9.2 | When the tape reader stops verify: (a) On the DSKY, the RESTART and PROG Caution lamps are lit. (b) The PGNS Caution lamps is lit. |
| 6.2.2.9.3 | On the DSKY, press the RSET pushbutton. Verify the RESTART, PROG and PGNS Caution lamps are not lit. |
| 6.2.2.9.4 | Start the tape reader. |
| 6.2.2.9.5 | When the tape reader stops verify: R1 = 00301 |

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| | |
|------------|--|
| 6.2.2.9.6 | Start the tape reader. |
| 6.2.2.9.7 | When the tape reader stops verify: <ul style="list-style-type: none"> (a) On the DSKY, the RESTART and PROG Caution lamps are lit. (b) The PGNS Caution lamp is lit. |
| 6.2.2.9.8 | On the DSKY, press the RSET pushbutton. Verify the RESTART, PROG and PGNS Caution lamps are not lit. |
| 6.2.2.9.9 | Start the tape reader. |
| 6.2.2.9.10 | When the tape reader stops verify: <ul style="list-style-type: none"> R1 = 00302 |
| 6.2.2.9.11 | Start the tape reader. |
| 6.2.2.9.12 | When the tape reader stops verify: <ul style="list-style-type: none"> R1 = 00400 |
| 6.2.2.10 | Nightwatchman Test |
| 6.2.2.10.1 | Start the tape reader. |
| 6.2.2.10.2 | When the tape reader stops verify: <ul style="list-style-type: none"> (a) On the DSKY, the RESTART and PROG Caution lamps are lit. (b) The PGNS Caution lamp is lit. |
| 6.2.2.10.3 | On the DSKY, press the RSET pushbutton. Verify the RESTART, PROG and PGNS Caution lamps are not lit. |
| 6.2.2.10.4 | Start the tape reader. |
| 6.2.2.10.5 | When the tape reader stops verify: <ul style="list-style-type: none"> R1 = 00401 |
| 6.2.2.11 | Bank Sum Check |
| 6.2.2.11.1 | From a program listing for the installed CMC ropes, obtain a list of bank CKSM bugger words. |

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POST INSTALLATION CHECKOUT PROCESS
 SPECIFICATION FOR THE APOLLO GUIDANCE &
 NAVIGATION SYSTEM BLOCK II-KSC

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| Date | Revision Letter | TDRR No. | Pages Revised | Approvals | |
|---------|-----------------|----------|--|-----------|------|
| | | | | AC | NASA |
| 8/21/68 | H | 36709 | 4, 9, 11-15, 22, 24, 26, 33, 34, 43, 46-51, 75, 78, 85, 86, 88, 89, 97, 98, 100, 101, 104, 105, 108-110, 112, 126, 128 and 144. Specification now comprised of a total of 145 pages. | SB | WLS |
| 9/5/68 | J | 36790 | 9 | EA | WLS |
| 5/1/69 | K | 37571 | 79, 80 | EA | RJJ |
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| 1/20/70 | M | 38002 | 21, 26, 58-144. Was 144, now 152 pages. | EA | MDH |

This specification consists of page 1 to 152 inclusive.

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| APPROVALS | NASA/MS | W.S. Swingle 2/17/67 | E. Austin 2/17/67 | R.D. Petryk |
| | | | | D. A. Ziemer AC |

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- 6.2.1.3.3 Set the computer numerical display lights to the minimum acceptable brightness by rotating the Brightness Controls on the MDC and LEB Lighting Control Panels.
- 6.2.1.3.4 The +28 VDC CMC OPERATE voltage (CG 1520) shall be $+28.8 \pm 3$ VDC. Verify CRT indication. On DSKY verify TEMP light is ON. On the G&N Indicator Control Panel verify PGNS light is ON.
- 6.2.1.3.5 The voltage output of the +4 VDC CMC supply shall be $+4.00 \pm 0.20$ VDC, (CG1030). The value on the CRT shall be recorded.
- 6.2.1.3.6 The voltage output of the +14 VDC CMC supply shall be $+14.0 \pm 0.4$ VDC, (CG1020). The value on the CRT shall be recorded.
- 6.2.1.3.7 Using DSKY, enter VERB 36, ENTR, then press RESET. Verify that R1, R2, R3, VERB, NOUN, and PROG are blank.
- 6.2.1.3.8 IMU HTR Heater Power On
- 6.2.1.3.8.1 Enter the IMU Standby Mode of operation by engaging the IMU HTR MN A and MN B breakers on the Right Hand Circuit Breaker Panel (breakers pushed in).
- NOTE: RESTART Lamp may illuminate, if it does, press RSET on the DSKY before proceeding.
- 6.2.1.3.8.2 Verify that the IMU +28 VDC STANDBY discrete lamp on Event Module is illuminated (CG 1513). On DSKY verify TEMP light is extinguished. On the G&N Indicator Control Panel verify PGNS light is extinguished.
- 6.2.1.3.8.3 Record the value of the following signals displayed on the CRT.
- | Signal | Requirement |
|--|---------------------|
| a. CG 1331 28V 3200 CPS POWER SUPPLY FEEDBACK | 28.6 ± 0.6 VRMS |
| b. CG 1510 +28 VDC STANDBY POWER | 28.8 ± 3 VDC |
- 6.2.1.3.8.4 The PIPA TEMP on the CRT shall be monitored at 15 min., 1 hr. and 2 hrs. from execution of 6.2.1.4.1 to insure that the PIPA Temperature Control Loop circuitry is operating to maintain a temperature of $130.5 \pm 1.5^\circ\text{F}$ (CG2300).
- 6.2.1.3.8.5 At the termination of the 2-hour period, record the PIPA temperature (CG2300) on the CRT. On the event recorder verify that the IMU HEATER current discrete (CG2302) is ON and that the IMU BLOWER current discrete (CG2303) is OFF over the last two hour period (occasionally discretely may cycle).

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- 6.2.2.5.8 Set the UP TLM switch on the MAIN DISPLAY Panel to BLOCK. Verify that the BLOCK UPLINK discrete is ON.
- 6.2.2.5.9 On K-148 insert VERB. Verify VERB indication on the DSKY and CRT does not change.
- 6.2.2.5.10 Set the UP TLM switch on the MAIN DISPLAY Panel to ACCEPT. Verify that the BLOCK UPLINK discrete is OFF. Remove the Block Uplink Override R-START.
- 6.2.2.5.11 On K-148 insert VERB 36. Press the ENTER pushbutton.
- 6.2.2.6 Alarms and Interrupts Test
- 6.2.2.6.1 Verify K-START tape F08C109-K10545-XX Alarms and Interrupts Test is on the K-START tape reader.
- 6.2.2.6.2 Start the tape reader.
- 6.2.2.6.3 When the tape reader stops verify:
 - R1 = +08282
 - R2 = +10545
 - R3 = -000XX
- 6.2.2.6.4 Start the tape reader.
- 6.2.2.6.5 When the tape reader stops verify:
 - R1 = 00100
- 6.2.2.7 Parity Fail Test
- 6.2.2.7.1 Start the tape reader.
- 6.2.2.7.2 When the tape reader stops verify:
 - (a) On the DSKY, the RESTART lamp is lit.
 - (b) The PGNS Caution lamp is lit.
- 6.2.2.7.3 On the DSKY, press the RSET pushbutton. Verify the RESTART and PGNS Caution lamps are not lit.
- 6.2.2.7.4 Start the tape reader.
- 6.2.2.7.5 When the tape reader stops verify:
 - R1 = 00101
- 6.2.2.7.6 Start the tape reader.

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- 6.2.9.24 (Cont) a. VERB 06 NOUN 98 flashing
b. R1 = 000xx
c. R2 = xxxxx
- Record R1 and R2 as the Shaft Optics CDU drive rate.
Shaft rate = $\frac{R1}{R2}$. The Shaft Optics CDU drive rate shall be
15.10 ± 3.78°/sec.
- 6.2.9.25 Enter VERB 33 into K148. Press the ENTR pushbutton. In about 15
seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98
b. R1 = 0000x
c. R2 = xxxxx
- Record R1 and R2 as the Trunnion Optics CDU drive rate. Trunnion
rate = $\frac{R1}{R2}$. The Trunnion Optics CDU drive rate shall be
3.77 ± 0.94°/sec.
- 6.2.9.26 Terminate the Semi-Automatic Moding Check by entering VERB 34
into K148. Observe PROG display on DSKY's is 00. Press the ENTER
pushbutton.
- 6.2.9.27 Computer Manual Mode Optics Drive
- NOTE: Perform the following procedure only if GNIC panel,
P/N 2021290-51 is installed in the spacecraft.
- 6.2.9.27.1 Place the OPTICS ZERO switch on the Indicator Control Panel to
ZERO and the OPTICS MODE switch to CMC.
- 6.2.9.27.1.1 Wait 20 seconds and then place the OPTICS ZERO switch on the Indicator
Control Panel to OFF.
- 6.2.9.27.1.2 Perform the following on the DSKY:
- VERB 41 NOUN 91 ENTR
+00000 ENTR
+00000 ENTR
- 6.2.9.27.2 Place the OPTICS MODE switch on the Indicator Control Panel to
MANUAL. Perform the following step within 1 minute.
- 6.2.9.27.2.1 Perform the following on the DSKY:
- VERB 21 NOUN 10 ENTR
00012 ENTR
00002 ENTR

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- 6.2.9.27.2.2 Perform the following on the DSKY:
- VERB 16 NOUN 91 ENTR
- Record R1 and R2 when the values settle out.
- 6.2.9.27.2.3 Set the OPTICS ZERO switch to ZERO.
- 6.2.9.27.2.4 Perform the following on the DSKY after a 10-second delay:
- VERB 24 NOUN 01 ENTR
00053 ENTR
00360 ENTR
00360 ENTR
VERB 21 NOUN 10 ENTR
00012 ENTR
00002 ENTR/ENTR
00014 ENTR
06000 ENTR
- 6.2.9.27.2.5 Set the OPTICS ZERO switch on the Indicator Control Panel to OFF.
- 6.2.9.27.2.6 Press the Key Release pushbutton. Record R1 and R2 when they are settled out.
- 6.2.9.27.2.7 Perform the following calculations for Shaft and Trunnion. Subtract the values of R1 and R2 from Step 6.2.9.27.2.2 from the respective values of R1 and R2 of Step 6.2.9.27.2.6.
- Verify $R1_6 - R1_2 = 10.65 \text{ deg} \pm 1.00 \text{ deg}$
and $R2_6 - R2_2 = 2.66 \text{ deg} \pm 0.26 \text{ deg}$
- 6.2.9.27.3 Set the SPEED switch to "MED" and the DIRECT/RESOLVED switch to DIRECT.
- 6.2.9.27.4 Set the OPTICS Hand Controller full right. Record R1 and release the Hand Controller.
- 6.2.9.27.4.1 Set the OPTICS Hand Controller full left. Record R1 and release the Hand Controller.
- 6.2.9.27.4.2 Perform the following calculations for Shaft. Subtract the value of R1 from Step 6.2.9.27.2.6 ($R1_{26}$) from the value of R1 recorded in Step 6.2.9.27.4 ($R1_{40}$).
- Verify $R1_{40} - R1_{26} = +1.63 \text{ deg} \pm 0.49 \text{ deg}$.
- Subtract the value of R1 from Step 6.2.9.27.2.6 ($R1_{26}$) from the value of R1 recorded in Step 6.2.9.27.4.1 ($R1_{41}$).
- Verify $R1_{41} - R1_{26} = -1.63 \text{ deg} \pm 0.49 \text{ deg}$.

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- 6.2.9.27.4.3 Set the OPTICS Hand Controller full up. Record R2 and release the Hand Controller.
- 6.2.9.27.4.4 Set the OPTICS Hand Controller full down. Record R2 and release the Hand Controller.
- 6.2.9.27.4.5 Perform the following calculations for Trunnion. Subtract the value of R2 from Step 6.2.9.27.2.6 (R2₂₆) from the value of R2 recorded in Step 6.2.9.27.4.3 (R2₄₃).
Verify $R2_{43} - R2_{26} = 0.40 \text{ deg} \pm 0.12 \text{ deg}$.
Subtract the value of R2 from Step 6.2.9.27.2.6 (R2₂₆) from the value of R2 recorded in Step 6.2.9.27.4.4 (R2₄₄).
Verify $R2_{44} - R2_{26} = -0.40 \text{ deg} \pm 0.12 \text{ deg}$.
- 6.2.9.27.5 Perform the following on the DSKY:
VERB 21 NOUN 10 ENTR
00012 ENTR
00000 ENTR
- 6.2.9.28 Set the G/N Power-Optics Switch on the LEB lighting control panel to OFF.
- 6.2.10 Zero Optics Test
- 6.2.10.1 Set the G&N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.
NOTE: Proceed with this test if 6.2.3 Operate Power on test has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2. Turn On Procedure before proceeding.
- INITIALIZATION
- 6.2.10.2 Insure that the following switches on the G&N Indicator Control Panel are set as follows:
a. OPTICS TEL TRUN to SLAVE to SXT
b. OPTICS COUPLING to DIRECT
c. OPTICS SPEED to HI
d. OPTICS MODE to MAN
OPTICS ZERO MODE TEST
- 6.2.10.3 Monitor the Optics CDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton.

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6.2.10.4 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Verify the Optics zeroed properly by observing the following on R1 and R2 of the CRT.

- a. R1 = $+0.00^{\circ} + 0.02^{\circ}$, -0.03° (Shaft Angle)
- b. R2 = $+0.000^{\circ} + 0.006^{\circ}$, -0.007° (Trunnion Los Angle)

6.2.10.4.1 Enter the following:

VERB 01 NOUN 10, ENTER
00033 ENTER

Verify R1 = XXX6X

6.2.10.4.2 Set the OPTICS ZERO switch to OFF and the OPTICS MODE switch to CMC. Enter the following:

ENTER
00033, ENTER

Verify R1 = XXX5X

6.2.10.4.3 Set the OPTICS MODE switch to MAN. Press the KEY-REL pushbutton.

OPTICS TIME TO ZERO TEST

6.2.10.5 Deleted.

6.2.10.6 Deleted.

6.2.10.7 Deleted.

6.2.10.8 Deleted.

6.2.10.9 Deleted.

6.2.10.10 Deleted.

6.2.10.11 Deleted.

OPTICS BACKUP MODE TEST

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- 6.2.10.12 Insert the Inflight Tool (V36601405) into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eyepiece while turning the tool until the TPAC reads +5°. Remove the tool from the Trunnion tool input.
- 6.2.10.13 Insert the Inflight Tool (V36601405) into the Shaft Tool input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool.
- 6.2.10.14 Insert the Inflight Tool (V36601405) into the Trunnion Tool input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool.
- 6.2.11 OPTICS Coordinate Transformation Control Test.
- 6.2.11.1 Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.
- NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding.
- INITIALIZATION
- 6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.
- a. OPTICS TEL TRUN to SLAVE to SXT
 - b. OPTICS COUPLING to DIRECT
 - c. OPTICS SPEED to HI
 - d. OPTICS MODE to MAN
- 6.2.11.3 Enter the following into the K-148.
- VERB 16 NOUN 91 ENTR
- 6.2.11.3.1 Deleted.
- 6.2.11.3.1.1 Deleted.
- 6.2.11.3.1.2 Deleted.

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- 6.2.11.4 CAUTION: See Paragraph 5.1.2.11 before proceeding.
Set the OPTICS ZERO switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS ZERO switch to OFF.
- 6.2.11.5 Set up the analog recorders to monitor the following measurements:
- a. CG 3170 SCT Trunnion Tachometer Output.
- RESOLVED MODE PHASING AND IMAGE RATE TEST.
- 6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until $R1 = +225.00$ and $R2 = +10.000$ on the CRT and the DSKY's.
- 6.2.11.7 Set the OPTICS COUPLING switch on the G&N Panel to RSLV and the OPTICS Speed switch to MED.
- 6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.
- 6.2.11.9 Record time. Quickly displace the OPTICS CONTROL STICK 45 ± 10 degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at 45 ± 10 deg. When target leaves the SCT upper right field of view press MARK pushbutton. The PROG alarm light shall light.
- 6.2.11.10 From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) and the PROG alarm discrete for the period during which the OPTICS CONTROL STICK was being displaced above. The Shaft CDU angle shall be 225.00 ± 10.00 degrees at the time the PROG alarm occurred. The elapsed time from time of OPTICS CONTROL STICK displacement to the time the PROG alarm discrete is obtained shall be 19 to 32 seconds.
- 6.2.11.11 Set the OPTICS COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the optics until $R1 = +225.00$ and $R2 = +10.000$. Set the OPTICS COUPLING switch to RSLV.
- 6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.

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- 6.2.11.13 CAUTION: See Paragraph 5.1.2.11 before proceeding.
Set the OPTICS COUPLING switch on the G&N Panel to DIRECT.
Set the OPTICS ZERO switch to ZERO.
- 6.2.12 OPTICS FUNCTIONAL TEST
- 6.2.12.1 Deleted.
- 6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:
- a. +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8 ± 3 VDC. Record the indication on the CRT.
 - b. CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.
 - c. CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT.
- 6.2.12.3 Deleted
- 6.2.12.4 CAUTION: See Paragraph 5.1.2.11 before proceeding.
Insure that the Optics control switches on the G&N Indicator Control Panel are set as follows:
- a. OPTICS ZERO to ZERO
 - b. OPTICS MODE to MAN
 - c. OPTICS SPEED to LO
 - d. OPTICS COUPLING to DIRECT
 - e. OPTICS TRUN to SLAVE to SXT
- 6.2.12.5 Set OPTICS ZERO switch to OFF.
- 6.2.12.6 Resolution checks
- 6.2.12.6.1 SXT Resolution Check - MSO only
- 6.2.12.6.1.1 Sight through the SXT eyepiece. Using the OPTICS CONTROL STICK, adjust the SXT to obtain the best reflected field of view of the 5-inch autocollimator reticle engravings at the center of view.
- 6.2.12.6.1.2 Note that the autocollimator reticle contains a series of lines of different thickness and width. Each set of lines is marked with a number (20, 15, 10, 7, 5, 3) which indicates the angle subtended by one line and one space. View each set of lines to determine the lowest numbered set in which resolution between lines (ability to distinguish separate distinct lines within a set) can be made. Record the number associated with that set of lines. The SXT resolution shall be at least 10 arc seconds at the center of the field of view.

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- 6.2.12.6.2 SCT Resolution Check
- 6.2.12.6.2.1 Sight through the SCT EYEPIECE. Using the OPTICS CONTROL STICK adjust the SCT to obtain the best view of the SCT RESOLUTION CHART held in the Optics line of sight.
- 6.2.12.6.2.2 Note the chart contains sets of lines. View each set of lines to determine the lowest numbered set in which the resolution between lines (ability to distinguish separate lines within a set) can be made. The SCT shall have a resolution of at least 3 arc minutes at the center of the field of view.
- 6.2.12.7 Slave Telescope Mode Checks
- 6.2.12.7.1 Verify/perform OPTICS POWER ON TEST per paragraph 6.2.3.2.
- 6.2.12.7.2 Set/Verify the following switches on G&N INDICATOR CONTROL PANEL:
- a. OPTICS TEL TRUN - SLAVE to SXT
 - b. OPTICS COUPLING - DIRECT
 - c. OPTICS SPEED - HI
- 6.2.12.7.3 Monitor OCDU's by entering VERB 16 NOUN 91 into K-148. Press ENTER.
- 6.2.12.7.4 Set OPTICS MODE to MAN.
- 6.2.12.7.5 Using the Optics Hand Controller drive the optics until:
- R1 = +000.00±001.00 (SHAFT)
R2 = +10.000±01.000 (TRUNNION)
- 6.2.12.7.6 Verify on the CRT and Optics Panel:
- SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.7 Set the OPTICS TEL TRUN on the G&N INDICATOR CONTROL PANEL to 0°.
- 6.2.12.7.8 Verify:
- SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = 0.0° ±0.22 DEG
- R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.9 Set the OPTICS TEL TRUN on the G&N INDICATOR CONTROL PANEL TO OFFSET 25°.

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- 6.2.12.7.10 Verify on CRT and Optics Panel:
- SHAFT TPAC = $R1 \pm 0.11$ DEG
TRUN TPAC = $25^\circ \pm 1.00$ DEG
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.11 On the G&N INDICATOR CONTROL PANEL set the OPTICS TEL TRUN to SLAVE to SXT.
- 6.2.12.7.12 Verify on CRT and Optics Panel:
- SHAFT TPAC = $R1 \pm 0.11$ DEG
TRUN TPAC = $R2 \pm 0.22$ DEG
- 6.2.12.7.13 CAUTION: See Paragraph 5.1.2.11 before proceeding.
On the G&N INDICATOR CONTROL PANEL set the OPTICS ZERO to ZERO.
Wait 15 sec.
- 6.2.12.7.14 Verify on CRT and OPTICS PANEL.
- $R1 = 000.00 +000.02, -000.03$
 $R2 = 00.000 +00.006, -00.007$
- SHAFT TPAC = $R1 \pm 0.11$ DEG
TRUN TPAC = $R2 \pm 0.22$ DEG
- 6.2.12.7.15 If Optics testing will not be continued, set the G&N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.8 SXT Parallelism Tests
- 6.2.12.8.1 Remove the plug from the base of the SXT eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light.
- NOTE: If needed to reduce external light, place a photographers hood over the optics head.
- 6.2.12.8.2 SXT Auto Collimator Parallelism Test - MSO only.
- 6.2.12.8.2.1 Using the OPTICS CONTROL STICK drive the SXT St LOS Trunnion to $+15.00^\circ \pm 2^\circ$ as indicated in R2 of the DSKY. Maintain a Shaft CDU angle of 000.00 ± 0.10 degrees.
- 6.2.12.8.2.2 Sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to superimpose the SXT LLOS horizontal reticle image upon the autocollimator horizontal filar. Record the autocollimator reading.

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- 6.2.12.8.2.3 Repeat 6.2.12.8.2.2 twice. Calculate and record the average of the three autocollimator readings.
- 6.2.12.8.2.4 Set the OPTICS ZERO switch to ZERO.
- 6.2.12.8.2.5 Again sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to bring the SXT St LOS horizontal reticle and autocollimator horizontal filar images to coincide. Record the autocollimator reading.
- 6.2.12.8.26 Repeat 6.2.12.8.2.5 twice. Calculate and record the average of the three autocollimator readings. The average value obtained here shall not differ from that obtained in 6.2.12.2.3 by more than 10 arc seconds.
- 6.2.12.8.3 Deleted.
- 6.2.12.8.3.1 Deleted.
- 6.2.12.8.3.2 Deleted.
- 6.2.12.8.3.3 Deleted.
- 6.2.12.8.3.4 Deleted.
- 6.2.12.9 SXT, CMC Functional Check
- 6.2.12.9.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to MAN. Set the OPTICS ZERO switch to ZERO. After 15 seconds, return the switch to OFF.
- 6.2.12.9.2 Sight through the SXT. Using the Control Stick align the SXT St LOS with Optical Target No. 1.
- 6.2.12.9.3 When aligned, record the value of the Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.4 Sight through the SXT. Using the Control Stick align the SXT St LOS with Optical Target No. 2.
- 6.2.12.9.5 When aligned, record the value of the Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.6 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. After 15 seconds set the OPTICS ZERO switch to OFF. Set the OPTICS MODE switch to CMC.

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- 6.2.12.9.7 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.3 into the DSKY and press ENTER. Enter the value for Trunnion from 6.2.12.9.3 into the DSKY and press ENTER.
- 6.2.12.9.8 Sight through the SXT. The St LOS should be approximately centered on the Optical Target No. 1. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.3 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.9 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for shaft from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton. Enter the value for Trunnion from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton.
- 6.2.12.9.10 Sight through the SXT. The St LOS should be approximately centered on the Optical Target No. 2. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.11 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds.
- 6.2.12.9.12 If OPTICS testing will not continue, set the G&N Power Optics switch on the LEB Lighting Panel to OFF.
- 6.2.13. Optics Slew Rate Test.
- 6.2.13.1 Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to the positions indicated:
- a. OPTICS TEL TRUN to SLAVE to SXT
 - b. OPTICS COUPLING to DIRECT
 - c. OPTICS SPEED to HI
 - d. OPTICS MODE to MAN.
- 6.2.13.2 Monitor the OCDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton. Insure RECORD DSKY AND RECORD DOWNLINK on R-145 are ON.
- 6.2.13.3 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch on the G&N Indicator Panel to OFF. Set the OPTICS MODE switch to MAN.

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6.2.13.3(Cont) NOTE: Read and understand step 6.2.13.4 before proceeding.
Do not hold Control Stick at upper limit more than 10 seconds or
exceed a trunnion angle of 85°.

TRUNNION SLEW RATE - HI SPEED

6.2.13.4 Record time. Push and hold the Optics Control Stick to its upper limit.
After approximately 7 seconds release the control stick. Record the SXT
Trunnion Servo Error In-Phase output (CG3118) signal on the CRT while
slewing the optics. The voltage shall be -0.25 to -2.00 VRMS.

6.2.13.5 Perform the following calculations:

From the Uplink file tape, the compressed data tape or the PCM tape
request a data reduction of the trunnion CDU register (address 35) and the
TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the
7 second period during which the rate test was being performed.

Calculate the slew rate by dividing the Δ CDU angle by the elapsed time.

The Trunnion slew rate shall be 10.0 ± 2.0 deg/sec.

SHAFT SLEW RATE - HI SPEED

6.2.13.6 CAUTION: See Paragraph 5.1.2.11 before proceeding.
Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS
ZERO switch to OFF.

NOTE: Read and understand step 6.2.13.7 before proceeding. Do not
hold Control Stick at right limit for more than 10 seconds or
exceed a shaft angle of 250°.

6.2.13.7 Record time. Push and hold the Optics Control stick to its right limit. After
approximately 7 seconds release the control stick.

Record the SXT Shaft Servo Error In-Phase Output (CG 3117) signal on the
CRT while slewing the optics. The voltage shall be -0.25 to -2.00 VRMS.

6.2.13.8 Perform the following calculations:

From the uplink file tape, the compressed data tape or the PCM tape,
request a data reduction of the Shaft CDU register (address 36) and the
TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7
second period during which the rate test was being performed.

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- 6.2.13.8
(Continued)
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Shaft slew rate shall be 19.5 ± 3.9 deg/sec.
- TRUNNION SLEW RATE - MED SPEED
- 6.2.13.9
- CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS SPEED switch to MED.
- NOTE: Read and understand 6.2.13.10 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.
- 6.2.13.10
- Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick. Record the SXT TRUN MTR Control Winding (CG 3155) and SXT Trun Tach (CG 3150) signals while slewing the optics. CG 3155 shall be $+0.25$ to $+2.00$ VRMS. CG 3150 shall be $+0.33 \pm 0.13$ VRMS.
- 6.2.13.11
- Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the Trunnion CDU registers (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Trunnion slew rate shall be 1.0 ± 0.2 deg/sec.
- SHAFT SLEW RATE - MED SPEED
- 6.2.13.12
- CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.
- NOTE: Read and understand 6.2.13.13 before proceeding. Do not hold control stick at right limit for more than 20 seconds.
- 6.2.13.13
- Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick. Record the SXT Shaft MTR Control Winding (CG 3145) and SXT Shaft Tach (CG 3140) signals while slewing the optics. CG 3145 shall be $+0.50$ to $+4.00$ VRMS. CG 3140 shall be 0.33 ± 0.13 VRMS.

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- 6.2.13.14 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Shaft slew rate shall be 2.0 ± 0.4 deg/sec.
- TRUNNION SLEW RATE - LO SPEED
- 6.2.13.15 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS SPEED switch to LO.
- NOTE: Read and understand 6.2.13.16 before proceeding. Do not hold control stick at upper limit for more than 30 seconds.
- 6.2.13.16 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.
- 6.2.13.17 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the Trunnion CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Trunnion slew rate shall be 0.10 ± 0.02 deg/sec.
- SHAFT SLEW RATE - LO SPEED
- 6.2.13.18 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF.
- NOTE: Read and understand 6.2.13.18 before proceeding. Do not hold control stick at right limit for more than 20 seconds.
- 6.2.13.19 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.

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- 6.2.13.20 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Shaft slew rate shall be 0.20 ± 0.04 deg/sec.
- OPTICS HAND CONTROLLER DRIFT RATE CHECK - LO SPEED
- 6.2.13.21 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to CTF. Record time. Wait 60 seconds.
- 6.2.13.22 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the Trunnion and Shaft CDU registers (addresses 35 and 36 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 60 second period during which the drift rate test was being performed.
- Calculate the drift rate by dividing the Δ CDU angles by the elapsed time.
- The Trunnion drift rate shall be less than .0167 deg/sec.
- The shaft drift rate shall be less than .0333 deg/sec.
- 6.2.13.23 If OPTICS testing will not continue; set the G/N Power-Optics switch on the LEB Lighting Control Panel to OFF.

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- 6.2.14 Stabilization Loop Step Response Test
- 6.2.14.1 Proceed with this test if the Operate Power On Test of 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform the Turn ON Procedure of 6.2.5.2 before proceeding.
- 6.2.14.2 Insure that the Carry-on Command Stimuli Unit, Model No. C14-200, is installed and connected.
- 6.2.14.3 Enter VERB 36 into K148. Press the ENTER pushbutton, then the ERROR RESET pushbutton.
- 6.2.14.4 Inner Gimbal Response Test.
- 6.2.14.4.1 Enter code 2032000000 in C-START Module 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2117 IGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.4.2 Enter VERB 41 NOUN 20 into K148. Press ENTER pushbutton.
- 6.2.14.4.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.4.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.4.5 Deleted.
- 6.2.14.4.6 Enter 0001 into R154. Verify and execute to apply +28 VDC ACE ENABLE to the PSAAM.
- 6.2.14.4.7 Enter 1000 into R155. Verify and execute to enter a DC step into the 1G stabilization loop.
- CAUTION: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.4.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.4.9 Enter 0000 into 4A2-A6-R155; the top part of switch should be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the 1G Stabilization Loop. The bottom part of switch shall be extinguished.
- 6.2.14.4.10 After the transient has died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.

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- 6.2.14.4.10.1 The inner gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.4.10.2 The maximum number of overshoots on the IGA Servo Error signals shall be three.
- 6.2.14.5 Middle Gimbal Response Test
- 6.2.14.5.1 Enter Code 2028000000 into C-START MODULE 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2147 MGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.5.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.5.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.5.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.5.5 Deleted.
- 6.2.14.5.6 Enter 0100 into 4A2-A6-R155. The top part of switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.5.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the MG Stabilization Loop.
- CAUTION: If the transient caused by the step input does not die within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.5.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.5.9 Enter 0000 into 4A2-A6-R155. The top part of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.
- 6.2.14.5.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.5.10.1 The middle gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.5.10.2 The maximum number of overshoots on the MGA Servo Error signals shall be three.

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- 6.2.14.6 Outer Gimbal Response Test
- 6.2.14.6.1 Enter code 2026000000 in C-START Module 4A1-A5-C156. Press XEQ/SEAL Pushbutton to call up CG 2177 OGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.6.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.6.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.6.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.6.5 Deleted.
- 6.2.14.6.6 Enter 0010 into 4A2-A6-R155. The top half of the switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.6.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the OG Stabilization Loops.
- NOTE: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.6.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.6.9 Enter 0000 into 4A2-A6-R155. The top half of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the OG Stabilization Loop.
- 6.2.14.6.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to $\pm 5\%$ of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.6.10.1 The outer gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.6.10.2 The maximum number of overshoots on the OGA Servo Error Signals shall be five.

- 6.2.14.7 Enter VERB 40 NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.14.7.1 Enter VERB 41 NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.14.7.2 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.3 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.4 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.5 Enter 0000 into R154. Verify and execute to remove +28 VDC ACE ENABLE.

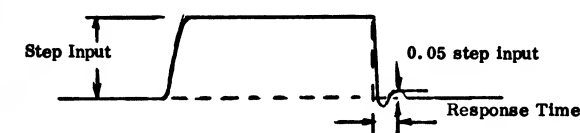


Figure 1. Typical Step Input Response

- 6.2.15 IRIG Scale Factor Test
- 6.2.15.1 Perform Master Initialization 6.2.5.3 before proceeding.
- 6.2.15.2 Verify that the IMU OPERATE power has been applied for a minimum of 1 hour, and that at least 1 hour has elapsed since running of the Gimbal Friction Test, 6.2.7.
- 6.2.15.3 Set up the Analog Recorders to monitor the following signals:
 - a. CG 2117 IG SERVO ERROR
 - b. CG 2147 MG SERVO ERROR
 - c. CG 2177 OG SERVO ERROR
 - d. CG 2120 IG TM CURRENT
 - e. CG 2150 MG TM CURRENT
 - f. CG 2180 OG TM CURRENT
- 6.2.15.3.1 Start the analog recorder chart drive using a chart speed of 1 mm/sec. The recorder shall run for the duration of 6.2.15.
- 6.2.15.4 Enter VERB 92 into K148. Press the ENTER pushbutton.
- 6.2.15.5 Enter 00005 into K148. Press the ENTER pushbutton. Program 07 shall be displayed.

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6.2.15.6 VERB 06 NOUN 41 shall flash on CRT and the following displayed in R1 and R2:

R1 = ±xxxxx (some Nav. Base azimuth)
R2 = ±xxxxx (some test site latitude; see table below).

6.2.15.7 If the values displayed in R1 and R2 are correct, proceed with test, if not perform the following sequence:

- a. To correct T1, on the K-148 enter VERB 21, press ENTER push-button, ±xxx.xx, press ENTER (±xxx.xx is correct nav. base azimuth).
- b. To correct R2, on the K-148 enter VERB 22, press ENTER push-button, ±xx.xxxx, press ENTER (obtain correct site latitude from table below).

Verify that the values in R1 and R2 are correct.

| SITE | LATITUDE |
|------------|----------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC MSO | +28.523 |
| KSC VAB | +28.585 |
| KSC PAD 39 | +28.607 |

6.2.15.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00001 ENTR

NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.8.

6.2.15.9 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+X IRIG Scale Factor error in part per million, Position +00001).

6.2.15.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00002 ENTR

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NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps of 6.2.15.4 through 6.2.15.7 and 6.2.15.10.

6.2.15.11 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor Error in parts per million, Position +00002).

6.2.15.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
+00003 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.12.

6.2.15.13 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (-Z IRIG Scale Factor error in parts per million, Position +00003).

6.2.15.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
-00001 ENTR

NOTE: If PROG lamp changes from 06 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 38 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.14.

6.2.15.15 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row (-X IRIG Scale Factor error in parts per million, Position -00001).

6.2.15.16 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
-00002 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.16.

6.2.15.17 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per million, Position -00002).

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- 6.2.15.18 On K-148 enter the following sequence:
VERB 33 ENTR (VERB 21 NOUN 97 shall flash)
-00003 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step or
PROG ALARM is ON, enter VERB 36 ENTR and repeat steps
6.2.15.4 through 6.2.15.7 and 6.2.15.18.
- 6.2.15.19 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and
record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per
million, Position -00003).
- 6.2.15.20 Repeat steps 6.2.15.8 through 6.2.15.19 twice to obtain second and
third set of data.
- 6.2.15.21 Terminate this test by entering in K-148: VERB 34 ENTER
- 6.2.15.22 The average of the three readings of Scale Factor Error for the 6 positions
shall be 0 ± 1750 PPM.
- 6.2.15.23 After completion of all test numbers, stop the analog recorders.
- 6.2.15.24 Enter VERB 40 NOUN 20, ENTER into K148.
- 6.2.15.25 Enter the following into K148:
a. VERB 41 NOUN 20 ENTR
b. +00000, ENTER
c. +00000, ENTER
d. +00000, ENTER

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6.2.16 IMU Performance Test

6.2.16.1 Proceed with this test if the Operate Power On Test of 6.2.3 or the Turn On Procedure of 6.2.5.2 has been completed and system operation has not been interrupted. If the system operation has been interrupted, perform Turn On Procedure of 6.2.5.2 before proceeding with this test.

6.2.16.2 Verify that the IMU Operate Power has been applied for at least one hour.

6.2.16.3 On K-148, enter the following:

VERB 92 ENTR

6.2.16.4 Enter 00001 into K-148. Press the ENTER pushbutton.

6.2.16.5 On the CRT DSKY display VERB 06 NOUN 41 shall flash. Verify R1 (Nav Base Azimuth) and R2 (Site Latitude) are correct.

6.2.16.6 If values for R1 and R2 are correct, proceed to next step. If values for R1 and R2 are incorrect, enter the following sequence into K-148.

VERB 24 ENTR
+XXX,XX ENTR (Correct navigation base azimuth ± 0.50 deg)
+XX,XXX ENTR (Correct site latitude from table below)

Verify values in R1 and R2 are correct.

| Location | Latitude |
|----------|----------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC-MSO | +28.523 |
| KSC-VAB | +28.585 |
| KSC-PAD | +28.607 |

6.2.16.7 On K-148, enter the following sequence:

VERB 33 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.8 On CRT DSKY display, verify R1 = +00900 (Time), R2 = +00000 (Test Index No.) and R3 = +00012 (Test Position). If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00012 ENTR (Test Position Entry)

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- 6.2.16.9 On K-148, enter the following sequence:
VERB 33 ENTR
- 6.2.16.10 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.11 On K-148, enter the following sequence:
VERB 21 NOUN 01 ENTR
02552 ENTR
XXXXX ENTR (value of R2 from 6.2.16.10)
VERB 34 ENTR
VERB 06 NOUN 98 shall flash
- 6.2.16.12 On CRT DSKY displays, verify R1 = +00900, R2 = +00000, and R3 = +00002.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00002 ENTR (Test Position Entry)
- 6.2.16.13 On K-148, enter the following sequence:
VERB 33 ENTR
- 6.2.16.14 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.15 On K-148, enter the following sequence:
VERB 33 ENTR
- 6.2.16.16 In approximately 90 seconds VERB 06 NOUN 98 shall flash. From the CRT, record R1 and R2.
- 6.2.16.17 On K-148, enter the following sequence:
VERB 33 ENTR
- 6.2.16.18 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2. Record CRT CDU gimbal angle indications and time.
- 6.2.16.19 On K-148, enter the following sequence:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash

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6.2.16.20 On CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00011.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

| | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00011 | ENTR (Test Position Entry) |

6.2.16.21 On K-148, enter the following sequence:

| | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.22 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.23 On K-148, enter the following sequence:

| | |
|---------|-----------------------------------|
| VERB 21 | NOUN 01 ENTR |
| 02554 | ENTR |
| KXXXX | ENTR (value of R2 from 6.2.16.22) |
| VERB 34 | ENTR |
| VERB 06 | NOUN 98 shall flash |

6.2.16.24 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00004.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

| | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00004 | ENTR (Test Position Entry) |

6.2.16.25 On K-148, enter the following sequence:

| | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.26 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.27 On K-148, enter the following sequence:

| | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.28 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.

6.2.16.29 On K-148, enter the following sequence:

| | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

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- 6.2.16.30 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.31 On K-148, enter the following sequence:
- | | |
|---------|---------------------|
| VERB 33 | ENTR |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.32 From the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00005.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- | | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00005 | ENTR (Test Position Entry) |
- 6.2.16.33 Record Time. On K-148 enter the following sequence:
- | | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.34 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset. The PROG alarm shall extinguish.
- 6.2.16.35 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, Record R1 and R2.
- 6.2.16.36 On K-148, enter the following sequence:
- | | |
|---------|---------------------|
| VERB 34 | ENTR |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.37 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00006.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2, and R3 are incorrect, enter the following sequence on K-148:
- | | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00006 | ENTR (Test Position Entry) |
- 6.2.16.38 Record Time. On K-148 enter the following sequence:
- | | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

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- 6.2.16.39 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset. The PROG alarm lamp shall extinguish.
- 6.2.16.40 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.
- 6.2.16.41 On K-148, enter the following sequence:
- | | |
|---------|---------------------|
| VERB 34 | ENTR |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.42 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00007.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- | | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00007 | ENTR (Test Position Entry) |
- 6.2.16.43 On K-148, enter the following sequence:
- | | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.44 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.45 On K-148, enter the following sequence:
- | | |
|---------|---------------------|
| VERB 34 | ENTR |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.46 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00008.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- | | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00008 | ENTR (Test Position Entry) |
- 6.2.16.47 On K-148, enter the following sequence:
- | | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.48 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

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6.2.16.49 On K-148, enter the following:

| | |
|---------|---------------------|
| VERB 34 | ENTR |
| VERB 06 | NOUN 98 shall flash |

6.2.16.50 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00009.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

| | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00009 | ENTR (Test Position Entry) |

6.2.16.51 On K-148, enter the following sequence:

| | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.52 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.53 On K-148, enter the following sequence:

| | |
|---------|---------------------|
| VERB 34 | ENTR |
| VERB 06 | NOUN 98 shall flash |

6.2.16.54 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00010.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

| | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00010 | ENTR (Test Position Entry) |

6.2.16.55 On K-148 enter the following sequence:

| | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.56 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.57 On K-148, enter the following sequence:

| | |
|---------|---------------------|
| VERB 34 | ENTR |
| VERB 06 | NOUN 98 shall flash |

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6.2.16.58 On CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00003.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

| | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00003 | ENTR (Test Position Entry) |

6.2.16.59 On K-148, enter the following sequence:

| | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.60 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.61 On K-148 enter the following sequence:

| | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.62 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2. Row 1 is whole part, Row 2 is fractional part. Units are cm/sec².

6.2.16.63 On K-148, enter the following sequence:

| | |
|---------|----------------------|
| VERB 34 | ENTR |
| VERB 06 | NOUN 98 shall flash. |

6.2.16.64 On CRT DSKY displays, verify R1 = +00900, R2 = +00000, and R3 = +00001.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

| | |
|---------|-----------------------------|
| VERB 25 | ENTR |
| +00900 | ENTR (Test Time in Seconds) |
| +00000 | ENTR (Test Index Number) |
| +00001 | ENTR (Test Position Entry) |

6.2.16.65 On K-148, enter the following sequence:

| | |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.66 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.67 On K-148, enter the following sequence:

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6.2.16.67 On K-148 enter the following sequence:
VERB 33 ENTR

6.2.16.68 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.

6.2.16.69 On K-148, enter the following sequence:
VERB 34 ENTR
VERB 06 NOUN 98 shall flash

6.2.16.70 On CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00013.
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
VERB 25 ENTR
+00900 ENTR (Test Time in Seconds)
+00000 ENTR (Test Index Number)
+00013 ENTR (Test Position Entry)

6.2.16.71 On K-148, enter the following sequence:
VERB 33 ENTR

6.2.16.72 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.73 Terminate this test by entering the following into K-148:
VERB 36 ENTR

6.2.16.74 On K-148 enter the following sequence:
VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

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6.2.16.75 Calculations

| Position No. as Displayed in R3 | Quantity Being Measured |
|------------------------------------|--|
| +00001 | +NBDY + ADOAY +X PIPA G |
| +00002 | +NBDZ - ADOAZ -X PIPA G -NBDX + ADIAX |
| +00003 | -NBDX - ADOAX +Z PIPA G |
| +00004 | +NBDY + ADSRAY -Z PIPA G +NBDZ + ADIAZ |
| +00005 | +Y PIPA G |
| +00006 | -Y PIPA G |
| +00007 | -NBDX + .707 (ADSRAX - ADOAX) |
| +00008 | -.707 (NBDZ + NBDY) +.5 (ADIAZ - ADIAY) +.5 (ADSRAY + ADSRAZ) |
| +00009 | -NBDZ + .707 (ADSRAX - ADOAZ) |
| +00010 | .707 (NBDY - NBDX) +.5 (ADIAZ - ADIAX) +.5 (ADSRAX) + .5 (ADOAY) |
| +00011 | +NBDX - ADOAX |
| +00012 | +NBDY - ADOAY |
| +00013 | +NBDZ + ADOAZ |

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6.2.16.75.1 Measured Values

| Line | Position No. | Parameter | Recorded Value |
|------|--------------|--|----------------|
| 1. | +00001 | +NBDY + ADOAY | R2 |
| 2 | +00001 | +X PIPA G | R1 * R2 |
| 3 | +00002 | +NBDZ - ADOAZ | R2 |
| 4 | +00002 | -X PIPA G | R1 * R2 |
| 5 | +00002 | -NBDX + ADIAX | R2 |
| 6 | +00003 | -NBDX - ADOAX | R2 |
| 7 | +00003 | +Z PIPA G | R1 * R2 |
| 8 | +00004 | +NBDY + ADSRAY | R2 |
| 9 | +00004 | -Z PIPA G | R1 * R2 |
| 10 | +00004 | +NBDZ + ADIAZ | R2 |
| 11 | +00005 | +Y PIPA G | R1 * R2 |
| 12 | +00006 | -Y PIPA G | R1 * R2 |
| 13 | +00007 | -NBDX + .707 (ADSRAX - ADOAX) | R2 |
| 14 | +00008 | .707 (-NBDZ - NBDY) + .5 (ADIAZ - ADIAY) + .5 (ADSRAY + ADSRAZ) | R2 |
| 15 | +00009 | -NBDZ + .707 (ADSRAX - ADOAZ) | R2 |
| 16 | +00010 | .707 (NBDY - NBDX) + .5 (ADIAZ - ADIAX) + .5 (ADSRAX) + .5 (ADOAY) | R2 |
| 17 | +00011 | +NBDX - ADOAX | R2 |
| 18 | +00012 | +NBDY - ADOAY | R2 |
| 19 | +00013 | +NBDZ + ADOAZ | R2 |

6.2.16.75.2 Y PIPA Data Correction Calculation

6.2.16.75.2.1 From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the X and Z accelerometer ΔV counts (addresses 37 and 41, respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) for the period during which the Y PIPA test was being performed in positions 5 and 6 of the IMU Performance test.

6.2.16.75.2.2 Perform the following calculations for position 5.

$$G'_5 = \frac{G_5}{\cos \theta y_5}$$

where:

G_5 = Measured acceleration term (line 11)

G'_5 = Corrected acceleration term

$$\cos \theta y_5 = 1 - \frac{\theta^2 y_5}{2} \text{ for small angles}$$

$$\theta y_5 = \sqrt{\theta^2 x_5 + \theta^2 z_5}$$

and:

$$\theta_{z5} = (\Delta V_{x5} - \Delta V_x \text{ Bias}) (S.F._x) / (\Delta T)(\text{local } g)$$

$$\theta_{x5} = (\Delta V_{z5} - \Delta V_z \text{ Bias}) (S.F._z) / (\Delta T)(\text{local } g)$$

and:

$$\Delta V_x \text{ Bias} = (X \text{ PIPA Bias})(\Delta T) / S.F._x$$

$$\Delta V_z \text{ Bias} = (Z \text{ PIPA Bias})(\Delta T) / S.F._z$$

6.2.16.75.2.3 Perform the following calculations for position 6.

$$G'_6 = \frac{G_6}{\cos \theta y_6}$$

where:

G_6 = Measured acceleration term (line 12)

G'_6 = Corrected acceleration term

$$\cos \theta y_6 = 1 - \frac{\theta^2 y_6}{2} \text{ for small angles}$$

6.2.16.17.2.3
(continued)

$$\sigma_{y_6} = \sqrt{\sigma_{x6}^2 + \sigma_{z6}^2}$$

and:

$$\sigma_{z6} = (\Delta V_{x6} - \Delta V_x \text{ Bias})(S.F._x) / (\Delta T) (\text{local } g)$$

$$\sigma_{x6} = (\Delta V_{z6} - \Delta V_z \text{ Bias})(S.F._z) / (\Delta T) (\text{local } g)$$

and:

$$\Delta V_x \text{ Bias} = (X \text{ PIPA Bias}) (\Delta T) / S.F._x$$

$$\Delta V_z \text{ Bias} = (Z \text{ PIPA Bias}) (\Delta T) / S.F._z$$

6.2.16.75.2.4 Compute the PIPA Scale Factor error in parts per million and record in Table X₁.

$$a. \text{ PIPA S.F. Error} = \left[\frac{2 \text{ local } g}{+ \text{PIPA } G - (- \text{PIPA } G)} - 1.000000 \right] 10^6$$

$$b. \text{ X PIPA S.F. Error} = \left[\frac{2 \text{ local } g}{\text{line 2} - \text{line 4}} - 1.000000 \right] 10^6$$

$$c. \text{ Y PIPA S.F. Error} = \left[\frac{2 \text{ local } g}{G'_5 - G'_6} - 1.000000 \right] 10^6$$

$$d. \text{ Z PIPA S.F. Error} = \left[\frac{2 \text{ local } g}{\text{line 7} - \text{line 9}} - 1.000000 \right] 10^6$$

The PIPA S.F. Error shall not exceed ± 1900 PPM

Local Gravity Values

| Location | Local Gravity (cm/sec ²) |
|----------|--------------------------------------|
| NAA | 979.56 |
| MSC | 979.29 |
| KSC | 979.24 |

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6.2.16.75.2.5 Compute the PIPA Bias in cm/sec^2 and record in Table X_1 .

$$\text{a. PIPA Bias} = \frac{+\text{PIPA G} + (-\text{PIPA G})}{2}$$

$$\text{b. X PIPA Bias} = \frac{\text{line 2} + \text{line 4}}{2}$$

$$\text{c. Y PIPA Bias} = \frac{G'_5 + G'_6}{2}$$

$$\text{d. Z PIPA Bias} = \frac{\text{line 7} - \text{line 9}}{2}$$

The PIPA Bias shall not exceed $\pm 2.28 \text{ cm/sec}^2$.

6.2.16.75.2.6 Calculate NBD, ADOA, ADSRA, and ADIA.

$$\text{a. NBDX} = \frac{-\text{line 6} + \text{line 17}}{2}$$

$$\text{NBDY} = \frac{\text{line 1} + \text{line 18}}{2}$$

$$\text{NBDZ} = \frac{\text{line 3} + \text{line 19}}{2}$$

NBD shall not exceed ± 15 meru. Record values in Table X_1 .

$$\text{b. ADOAX} = \frac{-\text{line 6} - \text{line 17}}{2}$$

$$\text{ADOAY} = \frac{\text{line 1} - \text{line 18}}{2}$$

$$\text{ADOAZ} = \frac{-\text{line 3} + \text{line 19}}{2}$$

$$\text{c. ADSRAX} = \frac{\text{line 13} + \text{NBDX}}{.707} + \text{ADOAX} =$$

$$\text{ADSRAY} = \text{line 8} - \text{NBDY} =$$

$$\text{ADSRZ} = \frac{\text{line 15} + \text{NBDZ}}{.707} + \text{ADOAZ} =$$

ADSR shall not exceed ± 40 meru/g. Record value in Table X_1 .

6.2.16.75.2.6 d. ADIAX = line 5 + NBDX =
(continued)

$$ADIAZ = \frac{\text{line 16} - .707(\text{NBDY} - \text{NBDX})}{.5} + \text{ADSRAX} + \text{ADIAX} - \text{ADOAY}$$

$$ADIAZ = \text{line 10} - \text{NBDZ} =$$

ADIA shall not exceed ± 100 meru/g. Record value in Table X₁

6.2.16.75.2.7 Perform the following calculations for each term in Table X₁, and record the results in Table D.

$$D_1 = |X_{i-1} - X_i|$$

$$D_2 = |X_{i-1} - X_i| + |X_{i-2} - X_{i-1}|$$

$$D_3 = |X_{i-3} - X_{i-2}| + |X_{i-2} - X_{i-1}| + |X_{i-1} - X_i|$$

X_i = data point just obtained

X_{i-1} = last historical data point

X_{i-2} = second last historical data point

X_{i-3} = third last historical data point

NOTE: D₁ calculations begin with the first data point after ISS pre-Vib;
D₂ calculations begin with the second data point after ISS Pre-Vib;
D₃ calculations begin with the third data point after Pre-Vib.

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6.2.16.75.3 Obtain data from last historical IRIG and PIPA test and complete Table X_{I-1}.

TABLE X_{I-1}

| PAREMETER | UNITS | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRAZ | meru/g | |
| ADIAX | meru/g | |
| ADIAZ | meru/g | |
| X PIPA S. F. Error | PPM | |
| Y PIPA S. F. Error | PPM | |
| Z PIPA S. F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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6.2.16.75.4 Obtain data from the second last historical IRIG and PIPA test and complete Table X₁₋₂.

TABLE X₁₋₂

| PARAMETER | UNITS | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRZ | meru/g | |
| ADIAX | meru/g | |
| ADIAZ | meru/g | |
| X PIPA S. F. Error | PPM | |
| Y PIPA S. F. Error | PPM | |
| Z PIPA S. F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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6.2.16.75.5 Obtain data from the third last historical IRIG and PIPA test and complete Table X₁₋₃.

TABLE X₁₋₃.

| PARAMETER | UNITS | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRAZ | meru/g | |
| ADIAX | meru/g | |
| ADIAZ | meru/g | |
| X PIPA S. F. Error | PPM | |
| Y PIPA S. F. Error | PPM | |
| Z PIPA S. F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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TABLE X₁

| PARAMETER | UNITS | CALCULATED VALUE |
|--------------------|---------------------|------------------|
| NBDX | meru | |
| NBDY | meru | |
| NBDZ | meru | |
| ADSRAX | meru/g | |
| ADSRAY | meru/g | |
| ADSRZ | meru/g | |
| ADLAX | meru/g | |
| ADLAY | meru/g | |
| ADLAZ | meru/g | |
| X PIPA S. F. Error | PPM | |
| Y PIPA S. F. Error | PPM | |
| Z PIPA S. F. Error | PPM | |
| X PIPA Bias | cm/sec ² | |
| Y PIPA Bias | cm/sec ² | |
| Z PIPA Bias | cm/sec ² | |

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TABLE D

| PARAMETER | UNITS | D ₁ | MAX | D ₂ | MAX | D ₃ | MAX |
|--------------------|---------------------|----------------|-----|----------------|-----|----------------|-----|
| NBDX | meru | | 6 | | 9 | | 11 |
| NBDY | meru | | 6 | | 9 | | 11 |
| NBDZ | meru | | 6 | | 9 | | 11 |
| ADSRAX | meru/g | | 14 | | 21 | | 25 |
| ADSRAY | meru/g | | 14 | | 21 | | 25 |
| ADSRAZ | meru/g | | 14 | | 21 | | 25 |
| ADIAx | meru/g | | 17 | | 33 | | 40 |
| ADIAy | meru/g | | 17 | | 33 | | 40 |
| ADIAz | meru/g | | 17 | | 33 | | 40 |
| X PIPA S. F. Error | PPM | | 400 | | 500 | | 600 |
| Y PIPA S. F. Error | PPM | | 400 | | 500 | | 600 |
| Z PIPA S. F. Error | PPM | | 400 | | 500 | | 600 |
| X PIPA Bias | cm/sec ² | | 0.5 | | 0.7 | | 0.9 |
| Y PIPA Bias | cm/sec ² | | 0.5 | | 0.7 | | 0.9 |
| Z PIPA Bias | cm/sec ² | | 0.5 | | 0.7 | | 0.9 |

6.2.16.75.6 Failure to meet the above criteria shall result in retest according to 5.4.2.

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- 6.2.17 SXT-NB-Fine Alignment Test
- 6.2.17.1 Deleted
- 6.2.17.2 The G&N shall have had OPERATE power applied for a minimum of 1 hour.
- 6.2.17.3 Set the G/N POWER-OPTICS switch to OPTICS. Verify that +28 VDC OPTICS OPERATE BUS (CG 1530) is $+28.0 \pm 3.0$ VDC. Verify that the OPTX 28V 800 cps 1% 0° ph (CG 1211) and OPTX 28V 800 cps 5% -90° ph (CG 1212) are not flashing on the CRT.
- 6.2.17.4 Deleted.
- 6.2.17.5 CAUTION: See Paragraph 5.1.2.11 before proceeding.
On the G&N Indicator Control Panel set the following switches to the position indicated.
- a. OPTICS TEL TRUN to SLAVE to SXT
 - b. OPTICS COUPLING to DIRECT
 - c. OPTICS SPEED to LO
 - d. OPTICS MODE to MAN
 - e. OPTICS ZERO to ZERO
- 6.2.17.6 Deleted.
- 6.2.17.7 Deleted
- 6.2.17.8 Initiate the test by entering the following sequence into the LEB DSKY.
- a. VERB 92, ENTER
 - b. 00003, ENTER
- 6.2.17.9 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data is display in R1 and R2 on the DSKY.
- a. R1 = +13500
 - b. R2 = +xx.xxx (Site Latitude from table below)

| <u>SITE</u> | <u>LATITUDE</u> |
|-------------|-----------------|
| NAA | +33.921 |
| MSC | +29.556 |
| KSC MSO | +28.523 |
| KSC VAB | +28.585 |
| KSC PAD 39 | +28.607 |

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- 6.2.17.10 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If the value displayed is other than +13500 in R1 and the correct Site Latitude in R2, correct the data by entering the following sequence into the DSKY.
- VERB 21, ENTER
 - +13500, ENTER
 - VERB 22, ENTER
 - +xx.xxx, ENTER (+xx.xxx = Site Latitude from table above)
 - VERB 33, ENTER
- 6.2.17.11 Observe VERB 25 NOUN 97 flashing on the DSKY. Enter the following sequence into the DSKY.
- +00001, ENTER (Position Number)
 - +00000, ENTER
 - +00001, ENTER
- 6.2.17.12 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- R1 = +xxx.xx (Y_{NB} Azimuth)
 - R2 = ±xx.xxx (Y_{NB} Elevation)
 - R3 = 00001
- 6.2.17.13 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct Y_{NB} azimuth and elevation, correct the data by entering the following sequence into the DSKY.
- VERB 24, ENTER
 - +xxx.xx±002.00 degrees, ENTER (Y_{NB} Azimuth)
 - +xx.xxx±02.000 degrees, ENTER (Y_{NB} Elevation)
 - VERB 33, ENTER
- 6.2.17.14 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- R1 = +xxx.xx (Z_{NB} Azimuth)
 - R2 = ±xx.xxx (Z_{NB} Elevation)
 - R3 = 00002
- 6.2.17.15 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct Z_{NB} azimuth and elevation, correct the data by entering the following sequence into the DSKY.
- VERB 24, ENTER
 - +xxx.xx±002.00 degrees, ENTER (Z_{NB} Azimuth)
 - +xx.xxx±02.000 degrees, ENTER (Z_{NB} Elevation)
 - VERB 33, ENTER

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- 6.2.17.16 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- a. R1 = +xxx.xx (Target 1 Azimuth)
 - b. R2 = +xx.xxx (Target 1 Elevation)
 - c. R3 = 00001
- 6.2.17.17 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct azimuth and elevation for Target 1, correct the data by entering the following sequence into the DSKY.
- a. VERB 24, ENTER
 - b. +xxx.xx±00.10 degrees, ENTER (Target 1 Azimuth)
 - c. ±xx.xxx±00.010 degrees, ENTER (Target 1 Elevation)
 - d. VERB 33, ENTER
- 6.2.17.18 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- a. R1 = +xxx.xx (Target 2 Azimuth)
 - b. R2 = ±xx.xxx (Target 2 Elevation)
 - c. R3 = 00002
- 6.2.17.19 If the data displayed is correct proceed to 6.2.17.22. If R1 and R2 do not contain the correct azimuth and elevation for Target 2, correct the data by entering the following sequence into the DSKY.
- a. VERB 24, ENTER
 - b. +xxx.xx±00.10 degrees, ENTER (Target 2 Azimuth)
 - c. ±xx.xxx±00.010 degrees, ENTER (Target 2 Elevation)
- 6.2.17.20 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to OFF. Enter VERB 33, ENTER into the DSKY.
- 6.2.17.21 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00001, on the DSKY set the OPTICS MODE switch on the G&N Indicator Control Panel to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.
- 6.2.17.22 Using the Optics Hand Controller, align the SXT StLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.

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- 6.2.17.23 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement of the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.24 Using the Optics Hand Controller, align the SXT StLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- NOTE: The following two MARKS must be performed as quickly as possible. In no case shall the time between the first and second MARK exceed two minutes.
- 6.2.17.25 After 20 seconds observe the DSKY for VERB 51 and NOUN 70 flashing and R1 = 00001. Set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.
- 6.2.17.26 Using the Optics Hand Controller, align the SXT StLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.27 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement to the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.28 Using the Optics Hand Controller, align the SXT StLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.29 In approximately 7 minutes VERB 06 NOUN 98 shall flash on the DSKY and the test results shall be displayed. R1 and R2 on the DSKY shall display the misalignment of one of the horizontal PIPA's in arc seconds (R1 = whole, R2 = fractional). Record R1 and R2. (See Table IV for PIPA displayed.)
- 6.2.17.30 Enter VERB 33 ENTER into the DSKY. When VERB 06 NOUN 98 flashes R1 and R2 on the DSKY shall display the misalignment of the second horizontal PIPA in arc seconds (R1 whole, R2 fractional). (See Table IV for PIPA displayed). Record R1 and R2.

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- 6.2.17.31 Enter VERB 34 ENTER into the DSKY to terminate the test. Wait 5 seconds.
- 6.2.17.32 Repeat steps 6.2.17.4 and 6.2.17.8 through 6.2.17.31 substituting No.00002 in 6.2.17.11.a.
- 6.2.17.33 Enter the following sequence into the DSKY:
- VERB 36, ENTER
 - VERB 41 NOUN 20, ENTER
 - +00000, ENTER
 - +00000, ENTER
 - +00000, ENTER
- 6.2.17.34 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.

Table IV. DISPLAY CONDITIONS AT TEST COMPLETION

| Position | SM Orientation | | | Horizontal Misalignment Component | |
|----------|-----------------|-----------------|-----------------|-----------------------------------|-----------------|
| | X _{SM} | Y _{SM} | Z _{SM} | 6.2.17.29 | 6.2.17.30 |
| 1. | UP | SW | SE | Y _{SM} | Z _{SM} |
| 2. | SE | SW | DN | X _{SM} | Y _{SM} |
| 3.* | SE | UP | SW | X _{SM} | Z _{SM} |

* Position 3 is not run in the Spacecraft because of GIMBAL LOCK considerations.

- 6.2.17.35 Calculations
- 6.2.17.35.1
- $Y_{SM} \text{ misalignment} = () \frac{R1.R2}{}$
 - $Z_{SM} \text{ misalignment} = () \frac{R1.R2}{}$
 - $X_{SM} \text{ misalignment} = () \frac{R1.R2}{}$
 - $Y_{SM} \text{ misalignment} = () \frac{R1.R2}{}$
- 6.2.17.35.2 Enter the latest values from 6.2.16 IMU Performance Test.
- X PIPA bias = $\frac{\quad}{\quad}$ cm/sec²
 - Y PIPA bias = $\frac{\quad}{\quad}$ cm/sec²
 - Z PIPA bias = $\frac{\quad}{\quad}$ cm/sec²
 - $\theta_x = 210$ (X PIPA bias) = $\frac{\quad}{\quad}$ arc sec.
 - $\theta_y = 210$ (Y PIPA bias) = $\frac{\quad}{\quad}$ arc sec.
 - $\theta_z = 210$ (Z PIPA bias) = $\frac{\quad}{\quad}$ arc sec.

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- 6.2.17.35.3 a. Y_{SM} misalignment (Bias corrected) = 6.2.17.35.1a - θ_y = _____ arc sec.
b. Z_{SM} misalignment (Bias corrected) = 6.2.17.35.1b - θ_z = _____ arc sec.
c. X_{SM} misalignment (Bias corrected) = 6.2.16.35.1c - θ_x = _____ arc sec.
d. Y_{SM} misalignment (Bias corrected) = 6.2.17.35.1d - θ_y = _____ arc sec.

The SM misalignment in each orientation, excluding PIPA bias, shall not exceed ± 150 arc seconds.

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6.2.18 Gyrocompassing Test

6.2.18.1 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify that +28 vdc OPTICS OPERATE BUS (CG 1530) is +28.0±3.0 vdc. Verify that the OPTX 28V 800 cps 1% 0° (CG 1211) and OPTX 28V 800 cps 5%-90° (CG 1212) are not flashing in the CRT.

6.2.18.2 Load the Inertial Instrument Calibration Data into the CMC using the following sequence:

| | | |
|---------------------|---------|------|
| VERB 21 | NOUN 01 | ENTR |
| 01716 | | ENTR |
| XXXXX (X PIPA BIAS) | | ENTR |
| | | ENTR |
| 01717 | | ENTR |
| XXXXX (X PIPA S.F.) | | ENTR |
| | | ENTR |
| 01720 | | ENTR |
| XXXXX (Y PIPA BIAS) | | ENTR |
| | | ENTR |
| 01721 | | ENTR |
| XXXXX (Y PIPA S.F.) | | ENTR |
| | | ENTR |
| 01722 | | ENTR |
| XXXXX (Z PIPA BIAS) | | ENTR |
| | | ENTR |
| 01723 | | ENTR |
| XXXXX (Z PIPA S.F.) | | ENTR |
| | | ENTR |
| 01724 | | ENTR |
| XXXXX (NBDX) | | ENTR |
| | | ENTR |
| 01725 | | ENTR |
| XXXXX (NBDY) | | ENTR |
| | | ENTR |
| 01726 | | ENTR |
| XXXXX (NBDZ) | | ENTR |
| | | ENTR |
| 01727 | | ENTR |
| XXXXX (ADLAX) | | ENTR |
| | | ENTR |
| 01730 | | ENTR |
| XXXXX (ADLAX) | | ENTR |
| | | ENTR |
| 01731 | | ENTR |
| XXXXX (ADLAZ) | | ENTR |
| | | ENTR |
| 01732 | | ENTR |
| XXXXX (ADSRAX) | | ENTR |

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6.2.18.2
(Continued)

| | |
|----------------|------|
| 01733 | ENTR |
| XXXXX (ADSRAY) | ENTR |
| | ENTR |
| 01734 | ENTR |
| XXXXX (ADSRAZ) | ENTR |

6.2.18.3 Enter NB Azimuth and Site Latitude (from table below) and Launch Azimuth into the CMC using the following sequence:

| | | |
|---------|---------|-----------------------------------|
| VERB 21 | NOUN 01 | ENTR |
| 2506 | | ENTR (NB Azimuth) |
| XXXXX | | ENTR (fraction of a Rev Hi order) |
| | | ENTR |
| 2507 | | ENTR (NB Azimuth) |
| XXXXX | | ENTR (fraction of a Rev Lo order) |
| | | ENTR |
| 2510 | | ENTR (Site Latitude) |
| XXXXX | | ENTR (fraction of a Rev Hi order) |
| | | ENTR |
| 2511 | | ENTR (Site Latitude) |
| XXXXX | | ENTR (fraction of a Rev Lo order) |
| | | ENTR |
| 2755 | | ENTR(Launch Azimuth) |
| XXXXX | | ENTR (fraction of a Rev Hi order) |
| | | ENTR |
| 2756 | | ENTR (Launch Azimuth) |
| XXXXX | | ENTR (fraction of a Rev Lo order) |

| <u>Location</u> | <u>Latitude (Fraction of a Rev)</u> <u>Hi Order</u> | <u>Low Order</u> |
|-----------------|--|------------------|
| NAA | 03007 | 36671 |
| MSC | 02423 | 23341 |
| KSC MSO | 02422 | 04033 |
| KSC VAB | 02424 | 36151 |
| KSC PAD 39 | 02425 | 37327 |

6.2.18.4 Enter the following into the CMC:

VERB 37 ENTER, 01 ENTER

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- 6.2.18.5 When PROG display changes to 02, record time as T_0 .
- 6.2.18.6 Gyro Compassing Accuracy
- 6.2.18.6.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. After 120 minutes from T_0 , set the OPTICS ZERO switch on the G&N Indicator to ZERO. Record Inner, Middle and Outer Gimbal CDU readings every 5 minutes for the next 2 hours.
- 6.2.18.6.2 Enter VERB 65, ENTER into DSKY.
Observe the PROGRAM display on the DSKY change to 03.
- 6.2.18.6.3 When VERB 06 NOUN 41 flashes on the DSKY, insure R1 and R2 display Target 1 azimuth and elevation.
- a. R1 = +XXX.XX (Target 1 azimuth)
 - b. R2 = +XX.XXX (Target 1 elevation)
 - c. R3 = 00001
- 6.2.18.6.4 Verify the data appearing in R1 and R2 and if correct, proceed. If not correct, perform the following sequence:
- a. VERB 24, ENTER
 - b. +XXX.XX, ENTER (Target 1 azimuth)
 - c. +XX.XXX, ENTER (Target 1 elevation)
- 6.2.18.6.5 After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY.
- 6.2.18.6.6 When VERB 06 NOUN 41 flashes on the DSKY, insure that R1 and R2 display Target 2 azimuth and elevation.
- a. R1 = XXX.XX (Target 2 azimuth)
 - b. R2 = XX.XXX (Target 2 elevation)
 - c. R3 = 00002.
- 6.2.18.6.7 Verify the data appearing in R1 and R2 and if correct, perform the following sequence:
- a. VERB 24, ENTER
 - b. +XXX.XX, ENTER (Target 2 azimuth)
 - c. +XX.XXX, ENTER (Target 2 elevation)

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- 6.2.18.6.8 After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY.
- 6.2.18.6.9 Using the Optics Hand Controller, align the SXT StLOS to Target 1 and press MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied with MARK, press MARK REJECT pushbutton and repeat this step.
- 6.2.18.6.10 Set the OPTICS SPEED switch to HI. Using the Optics Hand Controller, drive the SXT StLOS to the approximate position of Target 2.
- 6.2.18.6.11 Set the OPTICS SPEED switch to LO. Using the Optics Hand Controller, align the SXT StLOS to Target 2 and press the MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied, press the MARK REJECT pushbutton and repeat this step.
- 6.2.18.6.12 On the DSKY observe the following data displayed:
- a. VERB 06 NOUN 93
 - b. R1 = ±XX.XXX (X gyro elevation error)
 - c. R2 = ±XX.XXX (Y gyro elevation error)
 - d. R3 = ±XX.XXX (Z gyro azimuth error)
- Record R1, R2 and R3. The X and Y gyro elevation error shall be 0.00 ± 0.55 degrees, and the Z gyro azimuth error shall be 0.00 ± 0.3 degrees.
- 6.2.18.6.13 CAUTION: See Paragraph 5.1.2.11 before proceeding.
- Enter VERB 34 ENTER into the DSKY. Observe the PROGRAM display change to 02. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Immediately repeat Steps 6.2.18.6.2 through 6.2.18.6.13 twice.
- 6.2.18.6.14 Repeat Steps 6.2.18.6.2 through 6.2.18.6.13 at 150, 180 and 210 minutes from T₀.
- 6.2.18.6.15 Enter VERB 36 into the DSKY. Press the ENTER pushbutton.
- 6.2.18.6.16 Enter VERB 41 NOUN 20 into the DSKY. Press the ENTER pushbutton. Enter +00000 into the DSKY three times. Press the ENTER pushbutton after each entry. Set the G&N POWER OPTICS switch on the LEB Lighting Control Panel to OFF.

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- 6.2.18.7 Gyrocompassing Stability
 - 6.2.18.7.1 Calculate the average of the first three X and Y gyro elevation errors and the first three Z gyro azimuth errors.
 - 6.2.18.7.2 The last three X and Y gyro elevation errors shall not deviate from the baseline X and Y gyro elevation errors determined above by more than ± 0.15 degrees.
 - 6.2.18.7.3 The last three Z gyro azimuth errors shall not deviate from the baseline Z gyro azimuth error determined above by more than ± 0.06 degrees.

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6.2.19 CMC Voltage Margin Test

- 6.2.19.1 Verify that the G&N IMU HTR MNA & MNB circuit breakers are engaged, Computer NMA & NMB breakers are engaged, IMU MNA & MNB circuit breakers are not engaged, and the G&N Power - IMU switch on the LEB Lighting Control Panel is in the OFF position.
- 6.2.19.2 On the PSA Adapter Module set the INHIBIT VOLTAGE FAIL switch to ON.
- Caution: During the performance of this test the +4 VDC CMC Power Supply shall not be operated at less than +2.5 VDC or greater than 5.2 VDC (CG 1030). The +14 VDC CMC Power Supply shall not be operated at less than +8.5 VDC or greater than +17.0 VDC (CG 1020). Rotate the LEB LTS NUMERICS SEL to approximately center position. Decrease to absolute minimum discernible lighting.
- Note: The flashing indication of the CMC Power Supplies on CRT may be disregarded for this test. The charts in Table V may be used to determine approximate values for the "XX, X" values of C-156 voltage dial settings corresponding to various power supply voltages.
- 6.2.19.3 Into R154 insert 0001. Verify and execute.
- 6.2.19.3.1 Into R153 insert 1100. Verify and execute.
- 6.2.19.4 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.5 Into C156 insert -050001234. Verify and execute. Verify on the CRT that GV0106 is between -4.0 and -6.0 VDC.
- 6.2.19.6 Into R154 insert 0111. Verify and execute.
- 6.2.19.7 Observe CG 1020, +14 VDC CMC Power Supply and CG 1030, +4 VDC CMC Power Supply, on the CRT. Repeat 6.2.19.3 through 6.2.19.6 adjusting each C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC and CG 1030 is +3.40 (+0.03 - 0.00) VDC.
- 6.2.19.8 Initiate CMC Self Check by inserting the following into K148:
- a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- Wait 200 seconds

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- 6.2.19.9 Insure that the DSKY RESTART lamp and Program Alarm lamp does not light.
- 6.2.19.9.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.10 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify the RESTART lamp on the DSKY is lighted. Disregard other DSKY indications. If RESTART does not light, repeat 6.2.19.3. Verify CMC Warning masters alarm are lighted.
- 6.2.19.11 Set the INHIBIT VOLTAGE FAIL switch to ON. Insert the following into KI48:
 - a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- 6.2.19.12 Into R154 insert 00001. Verify and execute.
- 6.2.19.13 Into C156 insert +108001244. Verify and execute. Verify on the CRT that GV0116 is between +9.8 and +11.8 VDC.
- 6.2.19.14 Into R154 insert 0111. Verify and execute.
- 6.2.19.15 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.12 through 6.2.19.14 adjusting the C-Start entry until CG 1020 is 18.4 (+0.1, -0.0) VDC.
- 6.2.19.16 Press ERROR RESET on KI48. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.16.1 Into R154 insert 0011. Verify and execute.
- 6.2.19.17 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted.
- 6.2.19.18 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to ON. Into KI48 insert:
 - a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- 6.2.19.19 Into R154 insert 0001. Verify and execute.

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- 6.2.19.20 Into C156 enter +092001234. Verify and execute. Verify on the CRT that GV0106 is between +8.2 and +10.2 VDC.
- 6.2.19.21 Into R154 insert 0111. Verify and execute.
- 6.2.19.22 Observe CG 1030, +4 VDC CMC Power Supply on the CRT. Repeat 6.2.19.19 through 6.2.19.21 adjusting the C-Start entry until CG 1030 is +4.60 (+0.08, -0.00)VDC.
- 6.2.19.23 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.23.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.24 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Verify CMC Warning master alarms are lighted.
- 6.2.19.25 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to ON. Into K148 insert:
 - a. ERROR RESET
 - b. VERB 21 NOUN 27, ENTER
 - c. 77777, ENTER
- 6.2.19.26 Into R154 insert 0001. Verify and execute.
- 6.2.19.27 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.28 Into R154 insert 0111. Verify and execute.
- 6.2.19.29 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.26 through 6.2.19.28 adjusting the C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC.
- 6.2.19.30 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.30.1 Into R154 insert 0011. Verify and execute.

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- 6.2.19.31 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted.
- 6.2.19.32 Into R154 insert 0000. Verify and execute.
- 6.2.19.33 Terminate CMC Self-Check by inserting into K148.
- a. ERROR RESET
 - b. VERB 21, NOUN 27, ENTER
 - c. 00000, ENTER
- 6.2.19.34 Ensure that CG 1020, +14 VDC CMC Power Supply indication, is $+14.0 \pm 0.4$ and that CG 1030, +4 VDC CMC Power Supply indication is $+4.00 \pm 0.20$ VDC on the CRT.

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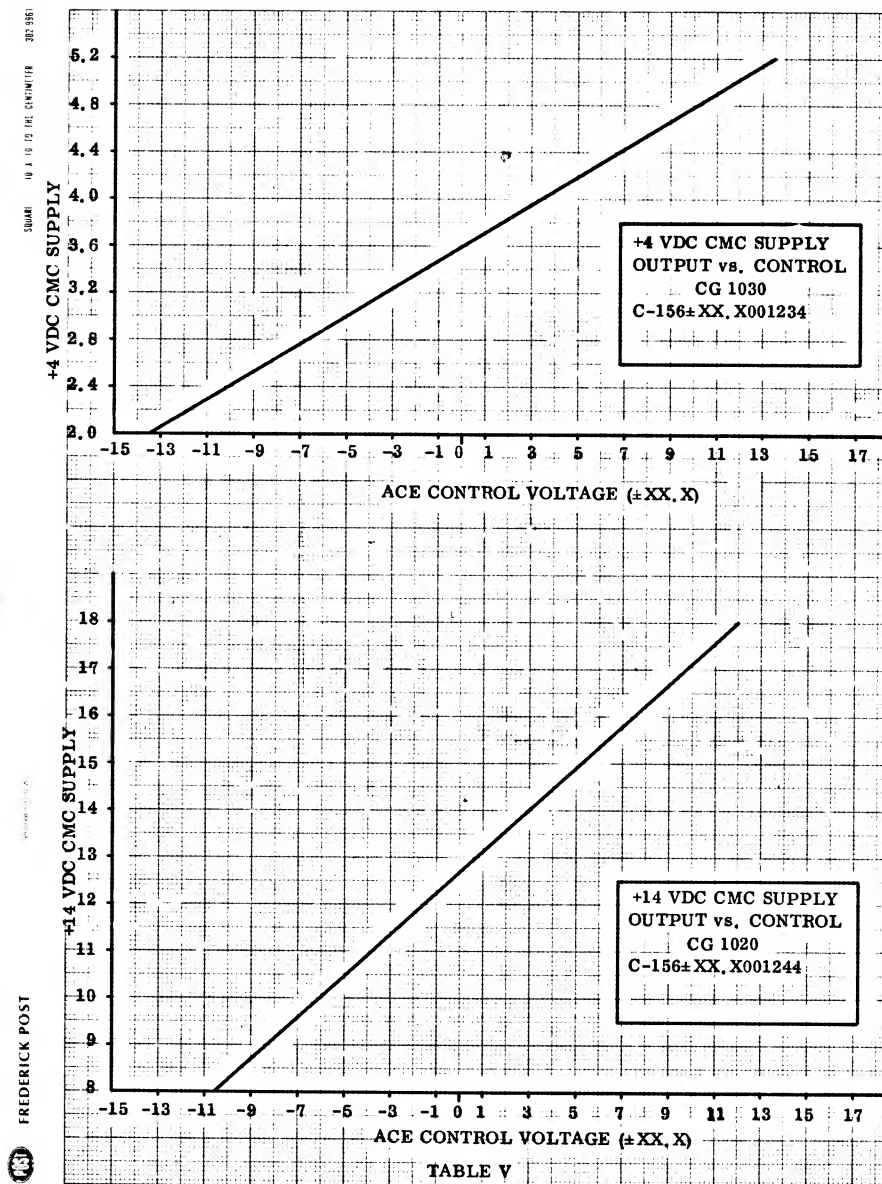


TABLE V

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- 6.2.20 Spacecraft Control and Displays Test.
- 6.2.20.1 Proceed with this test if the Operate Power on Test of 6.2.3 and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2 before proceeding.
- 6.2.20.2 FDAI Attitude Error.
- 6.2.20.2.1 Insert in KI48
- a. V92 ENTER
b. 00013 ENTER
- 6.2.20.2.2 Observe on the CRT PROG 07. In approximately 5 sec observe NO ATT ON. In approximately 20 sec observe V06 NO1 flashing and R1, R2 and R3 approximately 00000.
- 6.2.20.2.3 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.4 Observe on CRT
- a. V06 N 01 Flashing
b. R1 +00385
c. R2 -00385
d. R3 +00385
e. NO ATT OFF
- 6.2.20.2.5 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +5.06±0.50V rms
b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -5.06±0.50V rms
c. CG 2249 YAW ATT ERROR - CDU DAC OUT +5.06±0.50V rms
- 6.2.20.2.6 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.7 Observe on CRT
- a. V06 N01 Flashing
b. R1 +00384
c. R2 -00384
d. R3 +00384

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- 6.2.20.2.8 Record CRT indications.
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +5.06±0.50V rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -5.06±0.50V rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +5.06±0.50V rms
- 6.2.20.2.9 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.10 Observe on CRT
- a. V06 N01 Flashing
 - b. R1 +00160
 - c. R2 -00160
 - d. R3 +00160
- 6.2.20.2.11 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +2.11±0.21V rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -2.11±0.21V rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +2.11±0.21V rms
- 6.2.20.2.12 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.13 Observe on CRT
- a. V06 N01 Flashing
 - b. R1 +00135
 - c. R2 -00135
 - d. R3 +00135
- 6.2.20.2.14 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +1.78±0.18V rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -1.78±0.18V rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +1.78±0.18V rms
- 6.2.20.2.15 Insert in KI48
- a. VERB 33, ENTER

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- 6.2.20.2.16 Observe on CRT.
- a. V06 N01 Flashing
 - b. R1 +00090
 - c. R2 -00090
 - d. R3 +00090
- 6.2.20.2.17 Record CRT indications.
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +1.19±0.12V rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -1.19±0.12V rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +1.19±0.12V rms
- 6.2.20.2.18 Insert in K148.
- a. VERB 33, ENTER
- 6.2.20.2.19 Observe on CRT.
- a. V06 N01 Flashing
 - b. R1 +00000
 - c. R2 +00000
 - d. R3 -00090
- 6.2.20.2.20 Record CRT indications.
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT 0.00±0.06V rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT 0.00±0.06V rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT -1.19±0.12V rms
- 6.2.20.2.21 Insert in K148.
- a. VERB 33, ENTER
- 6.2.20.2.22 Observe on CRT.
- a. V06 N01 Flashing
 - b. R1 -00090
 - c. R2 +00090
 - d. R3 -00135
- 6.2.20.2.23 Record CRT indications.
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -1.19±0.12V rms
 - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +1.19±0.12V rms
 - c. CG 2249 YAW ATT ERROR - CDU DAC OUT -1.79±0.18V rms

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- 6.2.20.2.24 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.25 Observe on CRT
- a. V06 N01 Flashing
b. R1 -00135
c. R2 +00135
d. R3 -00160
- 6.2.20.2.26 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -1.78 ± 0.18 V rms
b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+1.78 \pm 0.18$ V rms
c. CG 2249 YAW ATT ERROR - CDU DAC OUT -2.11 ± 0.21 V rms
- 6.2.20.2.27 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.28 Observe on CRT
- a. V06 N01 Flashing
b. R1 -00160
c. R2 +00160
d. R3 -00384
- 6.2.20.2.29 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -2.11 ± 0.21 V rms
b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+2.11 \pm 0.21$ V rms
c. CG 2249 YAW ATT ERROR - CDU DAC OUT -5.06 ± 0.50 V rms
- 6.2.20.2.30 Insert KI48
- a. VERB 33, ENTER
- 6.2.20.2.31 Observe on CRT
- a. V06 N01 Flashing
b. R1 -00384
c. R2 +00384
d. R3 -00385

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6.2.20.2.32 Record CRT indications.

- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $-5.06 \pm 0.50V$ rms
- b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+5.06 \pm 0.50V$ rms
- c. CG 2249 YAW ATT ERROR - CDU DAC OUT $-5.06 \pm 0.50V$ rms

6.2.20.2.33 Insert in K148

- a. VERB 33, ENTER

6.2.20.2.34 Observe on CRT.

- a. V06 N01 Flashing
- b. R1 -00385
- c. R2 +00385
- d. R3 +00000

6.2.20.2.35 Record CRT indications.

- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT $-5.06 \pm 0.50V$ rms
- b. CG 2219 PITCH ATT ERROR - CDU DAC OUT $+5.06 \pm 0.50V$ rms
- c. CG 2249 YAW ATT ERROR - CDU DAC OUT $0.00 \pm 0.06V$ rms

6.2.20.2.36 Insert in K148.

- a. VERB 21 NOUN 01 ENTER
- b. 02545 ENTER
- c. 03362 ENTER
- d. VERB 33 ENTER

6.2.20.2.37 Observe on CRT.

- a. V06 N02 Flashing
- b. NO ATT ON
- c. R1 +00000 approximately
- d. R2 +00000 approximately
- e. R3 +00000 approximately

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- 6.2.20.3 TVC Test
- 6.2.20.3.1 The G/N Autopilot Control and SPS Ready discretes shall be applied to the G/N Interface.
- 6.2.20.3.2 Set the OPTICS MODE selector on the Indicator Control Panel to MAN. Set the OPTICS ZERO switch to OFF.
- 6.2.20.3.3 Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.3.4 Observe on CRT
- a. V 01 N10 Flashing
b. R1 X7373
c. R3 00030
- 6.2.20.3.5 Insert in KI48
- a. V33 ENTR
- 6.2.20.3.6 Observe on CRT
- a. V 01 Noun 10 Flashing
b. R1 37777
c. R3 00031
- 6.2.20.3.7 Insert in KI48
- a. V33 ENTER
- 6.2.20.3.8 Observe on CRT
- a. V06 N02 Flashing
b. R1 +00385
c. R2 -00385
d. R3 +00003
- 6.2.20.3.9 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +10.12±1.00V rms
b. CG 3721 SHAFT CDU DAC OUTPUT -10.12±1.00V rms
- 6.2.20.3.10 Insert in KI48
- a. VERB 33, ENTER

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- 6.2.20.3.11 Observe on CRT
- a. V06 N 02 Flashing
 - b. R1 +00384
 - c. R2 -00384
 - d. R3 +00003
 - e. NO ATT OFF
- 6.2.20.3.12 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +10.12±1.00V rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT -10.12±1.00V rms
- 6.2.20.3.13 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.3.14 Observe on CRT
- a. V06 N 02 Flashing
 - b. R1 +00160
 - c. R2 -00160
 - d. R3 +00003
- 6.2.20.3.15 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +4.22±0.42V rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT -4.22±0.42V rms
- 6.2.20.3.16 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.17 Observe on CRT
- a. V06 N 02 Flashing
 - b. R1 +00135
 - c. R2 -00135
 - d. R3 +00003
- 6.2.20.3.18 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +3.56±0.36V rms
 - b. CG 3721 SHAFT CDU DAC OUTPUT -3.56±0.36V rms
- 6.2.20.3.19 Insert in K148
- a. VERB 33 ENTER

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- 6.2.20.3.20 Observe on CRT
- | | | | |
|----|-----|-----|----------|
| a. | V06 | N02 | Flashing |
| b. | R1 | | +00090 |
| c. | R2 | | -00090 |
| d. | R3 | | +00003 |
- 6.2.20.3.21 Record CRT indications
- | | | |
|----|---------------------------------|-----------------|
| a. | CG 3722 TRUNNION CDU DAC OUTPUT | +2.38±0.24V rms |
| b. | CG 3721 SHAFT CDU DAC OUTPUT | -2.38±0.24V rms |
- 6.2.20.3.22 Set the OPTICS SPEED switch on the Indicator Control panel to HI.
- 6.2.20.3.23 Insert in KI48
- a. VERB 33 ENTER
- 6.2.20.3.24 Observe on CRT
- | | | | |
|----|-----|------|----------|
| a. | V06 | N 02 | Flashing |
| b. | R1 | | +00000 |
| c. | R2 | | +00000 |
| d. | R3 | | +00003 |
- 6.2.20.3.25 While holding the Optics Hand Controller up and left (45°) no longer than 10 seconds, record CRT indications.
- | | | |
|----|---------------------------------|----------------|
| a. | CG 3722 TRUNNION CDU DAC OUTPUT | 0.00±0.12V rms |
| b. | CG 3721 SHAFT CDU DAC OUTPUT | 0.00±0.12V rms |
- 6.2.20.3.26 Insert in KI48
- a. VERB 33 ENTER
- 6.2.20.3.27 Observe on CRT
- | | | | |
|----|-----|------|----------|
| a. | V06 | N 02 | Flashing |
| b. | R1 | | -00090 |
| d. | R2 | | +00090 |
| d. | R3 | | +00003 |
- 6.2.20.3.28 Record CRT indications
- | | | |
|----|---------------------------------|-----------------|
| a. | CG 3722 TRUNNION CDU DAC OUTPUT | -2.38±0.24V rms |
| b. | CG 3721 SHAFT CDU DAC OUTPUT | +2.38±0.24V rms |

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- 6.2.20.3.29 Set the OPTICS ZERO switch and the Indicator Control panel to ZERO for 30 seconds then return to OFF.
- 6.2.20.3.30 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.31 Observe on CRT
- a. V06 N 02 Flashing
b. R1 -00135
c. R2 +00135
d. R3 +00003
- 6.2.20.3.32 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -3.56±0.36V rms
b. CG 3721 SHAFT CDU DAC OUTPUT +3.56±0.36V rms
- 6.2.20.3.33 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.34 Observe on CRT
- a. V06 N 02 Flashing
b. R1 -00160
c. R2 +00160
d. R3 +00003
- 6.2.20.3.35 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -4.22±0.42V rms
b. CG 3721 SHAFT CDU DAC OUTPUT +4.22±0.42V rms
- 6.2.20.3.36 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.37 Observe on CRT
- a. V06 N 02 Flashing
b. R1 -00384
c. R2 +00384
d. R3 +00003

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6.2.20.3.38 Record CRT Indications

- a. CG 3722 TRUNNION CDU DAC OUTPUT -10.12±1.00V rms
- b. CG 3721 SHAFT CDU DAC OUTPUT +10.12±1.00V rms

6.2.29.3.39 Insert in K148

- a. VERB 33 ENTER

6.2.20.3.40 Observe on CRT

- a. V06 N 02 Flashing
- b. R1 -00385
- c. R2 +00385
- d. R3 +00003

6.2.20.3.41 Record CRT Indications

- a. CG 3722 TRUNNION CDU DAC OUTPUT -10.12±1.00V rms
- b. CG 3721 SHAFT CDU DAC OUTPUT +10.12±1.00V rms

6.2.20.3.42 Insert in K148

- a. V 34 ENTER
- b. V 41 N 20 ENTER
- c. V 41 N 20 ENTER
- d. +00000 ENTER
- e. +00000 ENTER
- f. +00000 ENTER

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APPENDIX I

| Signal | Link | Nomenclature | G&N Test Requirement | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|---------------------------------|--|--|
| CG 1020 | 1 | +14 VDC CMC SUPPLY | +14.0±0.4 VDC | 0% |
| CG 1021 | 1 | +14V CMC SUPPLY NOISE RMS | 0.2 VRMS MAX | 0% |
| CG 1030 | 1 | +4 VDC CMC SUPPLY | +4.00±0.2 VDC | 0% |
| CG 1031 | 1 | +4V CMC SUPPLY NOISE RMS | 0.2 VRMS MAX | 0% |
| CG 1040 | 2 | +120 VDC PIPA SUPPLY | +120±6.0 VDC | 1% |
| CG 1042 | 1 | +120 VDC PIPA SUP NOISE RMS | 1.5 VRMS MAX | 0% |
| CG 1051 | 1 | +20 VDC PIPA SUPPLY | +20.0±1.2 VDC | 0% |
| CG 1052 | 1 | -20 VDC PIPA SUPPLY | -20±2 VDC | 0% |
| CG 1053 | 1 | +20 VDC PIPA SUP NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1070 | 1 | +4 VDC CDU SUPPLY | +4.0±0.2 VDC | 0% |
| CG 1071 | 1 | +4 VDC CDU SUP NOISE RMS | 0.1 VRMS MAX | 0% |
| CG 1100 | 1 | -28 VDC SUPPLY | -27.5±6.0 VDC | 0% |
| CG 1110 | 2 | 2.5 VDC TM BIAS | +2.50±0.06 VDC | 0% |
| CG 1201 | 2 | IMU 28V .8KC 1% 0° RMS | 28.00±0.56 VRMS | 1% |
| CG 1202 | 1 | IMU 28V .8KC 5% - 90° RMS | 28.0±1.4 VRMS | 0.33% |
| CG 1203 | 1 | IMU 28V .8KC 0° RMS | 28.0±2.1 VRMS | 0.33% |
| CG 1207 | 1 | PH DIFF IMU 5% 0° , -90° | -90±10° | 2.3% |
| CG 1211 | 1 | OPTX 28V .8KC 1% 0° RMS | 28.00±0.56 VRMS | 0.33% |
| CG 1211 | 2 | OPTX 28V .8KC 1% 0° RMS | 28.00±0.56 VRMS | 1% |
| CG 1212 | 1 | OPTX 28V .8KC 5% - 90° RMS | 28.00±1.48 VRMS | 0.33% |
| CG 1220 | 1 | PH DIFF OPTX 1% IMU 1% | 0° ±10 | 2.3% |
| CG 1331 | 2 | 3.2 KC 28V SUPPLY | 28.6±0.56 VRMS | 1% |
| CG 1336 | 1 | PH DIFF 3.2 KC 28V/CMC SYNC | 0° ±10° | 2.3% |
| CG 1500 | 1 | +28 VDC IMU OPERATE BUS | 28.8±3 VDC | 0% |
| CG 1501 | 1 | +28V IMU OPERATE BUS NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1510 | 1 | +28 VDC IMU STANDBY BUS | 28.8±3 VDC | 0% |
| CG 1511 | 1 | +28V IMU STANDBY BUS NOISE RMS | 1.0 VRMS MAX | 0% |
| CG 1520 | 1 | +28 VDC CMC OPERATE BUS | 28.8±3 VDC | 0% |
| CG 1521 | 1 | +28V CMC OPERATE BUS NOISE RMS | 2.0 VRMS MAX | 0% |
| CG 1530 | 1 | +28 VDC OPTX OPERATE BUS | 28.8±3 VDC | 0% |
| CG 1531 | 1 | +28V OPTX OPERATE BUS NOISE RMS | 2.0 VRMS MAX | 0% |
| CG 2001 | 2 | X PIPA SG O/P | 5 VRMS max | 3% |
| CG 2021 | 2 | Y PIPA SG O/P | 5 VRMS max | 3% |
| CG 2041 | 2 | Z PIPA SG O/P | 5 VRMS max | 3% |
| CG 2108 | 1 | IG SERVO ERROR QUAD | 0.0±1.2 VRMS | 3.6% |
| CG 2112 | 2 | IG 1X RESOLVER O/P SIN | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2113 | 2 | IG 1X RESOLVER O/P COS | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2117 | 2 | IG SERVO ERROR IN PHASE | 0.0±60 mv RMS @ null | 1.4% |
| CG 2120 | 1 | IG TORQUE MOTOR CURRENT | 0.125 amp max during Fine Alignment Torquing | 0% |

APPENDIX I (Continued)

| Signal | Link | Nomenclature | G&N Test Requirement | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|--------------------------------|--|--|
| CG 2138 | 1 | MG SERVO ERROR QUAD | 0.0±1.2 VRMS | 3.6% |
| CG 2142 | 2 | MG 1X RESOLVER O/P SIN | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2143 | 2 | MG 1X RESOLVER O/P COS | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2147 | 2 | MG SERVO ERROR IN PHASE | 0.0±60 mv rms @ null | 1.4% |
| CG 2150 | 1 | MG TORQUE MOTOR CURRENT | 0.125 amp max during Fine Align Torquing | 0% |
| CG 2168 | 1 | OG SERVO ERROR QUAD | 0.0±1.2 VRMS | 3.6% |
| CG 2172 | 2 | OG 1X RESOLVER O/P SIN | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2173 | 2 | OG 1X RESOLVER O/P COS | 18.38±1.84 VRMS @ 45° | 2.5% |
| CG 2177 | 2 | OG SERVO ERROR IN PHASE | 0.0±60 mv RMS @ null | 1.4% |
| CG 2180 | 1 | OG TORQUE MOTOR CURRENT | 0.125 amp max during Fine Align Torquing | 0% |
| CG 2219 | 1 | PITCH ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS @ 17° | 0.67% |
| CG 2219 | 2 | PITCH ATT ERROR-CDU DAC O/P | 5.06±5 VRMS @ null | 1% |
| CG 2220 | 1 | IG CDU FINE ERROR | 0.0±0.07 VRMS @ null | 0.29% |
| CG 2221 | 1 | IG CDU COARSE ERROR | 0.0±0.68 VRMS at null | 0.29% |
| CG 2249 | 1 | YAW ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS at 17° | 0.67% |
| CG 2249 | 2 | YAW ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS @ null | 1% |
| CG 2250 | 1 | MG CDU FINE ERROR | 0.0±0.07 VRMS at null | 0.29% |
| CG 2251 | 1 | MG CDU COARSE ERROR | 0.0±0.68 VRMS at null | 0.29% |
| CG 2279 | 1 | ROLL ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS at 17° | 0.67% |
| CG 2279 | 2 | ROLL ATT ERROR-CDU DAC O/P | 5.06±0.5 VRMS @ null | 1% |
| CG 2280 | 1 | OG CDU FINE ERROR | 0.0±0.07 VRMS at null | 0.29% |
| CG 2281 | 1 | OG CDU COARSE ERROR | 0.0±0.68 VRMS | 0.29% |
| CG 2300 | 2 | PIPA TEMPERATURE | 130.5±1.5° F Operate Mode | 2% |
| CG 2301 | 1 | IRIG TEMPERATURE | 135±2.5° F in Operate | 2% |
| CG 2301 | 2 | IRIG TEMPERATURE | 135±2.5° F in Operate | 1% |
| CG 3011 | 1 | TRUNNION CDU FINE ERROR | 0.0±0.07 VRMS at null | 0.29% |
| CG 3011 | 2 | TRUNNION CDU FINE ERROR | 0.0±0.07 VRMS @ null | 1% |
| CG 3021 | 1 | SHAFT CDU FINE ERROR | 0.0±0.07 VRMS at null | 0.29% |
| CG 3021 | 2 | SHAFT CDU FINE ERROR | 0.0±0.07 VRMS @ null | 1% |
| CG 3117 | 1 | SXT SHAFT SERVO ERROR IN PH | -0.25 to -2.00 VRMS at Hi Rate | 1.1% |
| CG 3118 | 1 | SXT TRUNNION SERVO ERROR IN PH | -0.25 to -2.00 VRMS at Hi Rate | 1.1% |
| CG 3140 | 1 | SXT SHAFT TACH O/P | 3.3±1.3 VRMS at Hi Rate | 1.1% |
| CG 3140 | 2 | SXT SHAFT TACH O/P | 3.3±1.3 VRMS @ Hi Rate | 2% |
| CG 3145 | 1 | SXT SHAFT MTR CONTROL WINDING | +0.5 to 4.00 VRMS at Med Rate | 1.1% |
| CG 3150 | 1 | SXT TRUNNION TACH O/P | 3.3±1.3 VRMS at Hi Rate | 1.1% |
| CG 3150 | 2 | SXT TRUNNION TACH O/P | 3.3±1.3 VRMS @ Hi Rate | 2% |

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| <u>Signal</u> | <u>Link</u> | <u>Nomenclature</u> | <u>G&N Test Requirement</u> | <u>PSAAM and/or SCA Uncertainty % of Full Scale</u> |
|---------------|-------------|----------------------------------|---------------------------------|---|
| CG 3155 | 1 | SXT TRUNNION MTR CONTROL WINDING | +0.25 to +2.00 VRMS at Med Rate | 1.1% |
| CG 3160 | 1 | SCT SHAFT TACH O/P | 3.3±1.3 VRMS at Hi Rate | 1.1% |
| CG 3160 | 2 | SCT SHAFT TACH O/P | 3.3±1.3 VRMS at Hi Rate | 2% |
| GC 3170 | 1 | SCT TRUNNION TACH O/P | 0.85±0.35 VRMS at Hi Rate | 1.1% |
| CG 3170 | 2 | SCT TRUNNION TACH O/P | 0.85±0.35 VRMS at Hi Rate | 2% |
| CG 3721 | 2 | SHAFT CDU DAC O/P | 10.12±1.00 VRMS at 17° | 1% |
| CG 3722 | 2 | TRUNNION CDU DAC O/P | 10.12±1.00 VRMS at 17° | 1% |
| CG 4300 | 1 | CMC TEMP | 87.5±42.5° F | 0.23% |
| CG 6020 | 1 | PIPA CAL MODULE TEMP | 72.5±27.5° F | 0.23% |
| CG 6021 | 1 | IMU 800 cps 5% TEMP (PSA) | 90±30° F | 0% |

PSAAM OUTPUT is the source of Link 1 signals. SCA OUTPUT is the source of Link 2 signals.

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ADDENDUM I - Deleted

ADDENDUM II - Deleted

ADDENDUM III

SCOPE: The following changes are required to make ND1002348 applicable as a G&N
System Technical support document for CSM 101.

- Change 1. Add paragraph 6.1.1.7 as follows:
- 6.1.1.7 Data from the on board tape recorder shall be made available and the following signals verified:
- a. IG TORQUE MOTOR CURRENT (CG 2120) shall be less than 0.125 amp max.
 - b. OG TORQUE MOTOR CURRENT (CG 2180) shall be less than 0.125 amp max.
 - c. MG TORQUE MOTOR CURRENT (CG 2150) shall be less than 0.125 amp max.
- Change 2. Paragraph 6.2.1.3.8.5 change the last sentence to read as follows:
- On the Event Recorder verify that the IMU HTR Current discrete (CG 2302 FQ) is ON and that the IMU Blower Current discrete (CG 2303 FQ) is OFF over the last 2 hour period (occasionally discrete may cycle).
- Change 3. Add paragraph 6.2.4.6.1 as follows:
- 6.2.4.6.1 On the analog recorder verify that CG 1211 FQ, OPTICS 28V 800 cps 1% deg. RMS voltage is 28.0 ± 0.6 VAC.
- Change 4. Add paragraph 6.2.20.2.5.1 and 6.2.20.2.32.1 as follows:
- 6.2.20.2.5.1 Verify on the analog recorder the following signals:
- a. CG 2279 FQ ROLL ATT ERROR - CDU DAC OUT $+5.06 \pm 0.50$ VRMS
 - b. CG 2219 FQ PITCH ATT ERROR - CDU DAC OUT -5.06 ± 0.50 VRMS
 - c. CG 2249 FQ YAW ATT ERROR - CDU DAC OUT $+5.06 \pm 0.50$ VRMS
- 6.2.20.2.32.1 Verify on the analog recorder the following signals:
- a. CG 2279 FQ ROLL ATT ERROR - CDU DAC OUT -5.06 ± 0.50 VRMS
 - b. CG 2219 FQ PITCH ATT ERROR - CDU DAC OUT $+5.06 \pm 0.50$ VRMS
 - c. CG 2249 FQ YAW ATT ERROR - CDU DAC OUT -5.06 ± 0.50 VRMS

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- Change 5 Add new paragraph 6.1.1.8 as follows:
- From the on board tape recorder verify the presence of the following signals:
- a. VIB NB ROLL (CG 6001)
 - b. VIB NB PITCH (CG 6002)
 - c. VIB NB YAW (CG 6003)
- Change 6 Paragraph 6.2.1.3.8.5 add to the first sentence the following:
- "...PIPA TEMP (CG 2300) and IRIG TEMP (CG 2301) on the CRT."
- Add Paragraph 6.2.3.1.13 as follows:
- 6.2.3.1.13 "30 minutes after the application of IMU OPERATE power record IRIG TEMP (CG 2301) displayed on the CRT".
- Paragraph 6.2.3.1.14, add to the first sentence the following:
- "...PIPA TEMP (CG 2300) and IRIG TEMP (CG 2301) every..."
- Paragraph 6.2.3.1.15 change to read as follows:
- "When 2 hours have elapsed since the application of IMU OPERATE power record PIPA TEMP and IRIG TEMP. PIPA TEMP shall be $130.5^{\circ} \pm 1.5^{\circ} \text{F}$. IRIG TEMP shall be $135^{\circ} \pm 2.5^{\circ} \text{F}$. PIPA TEMP shall be within 0.5°F of that recorded in 6.2.3.1.12 and 6.2.1.3.8.4. IRIG TEMP shall be within 0.5°F of that recorded in 6.2.3.1.13".
- Paragraph 6.2.5.2.16, add measurement No. 13 to table as follows:
- "13 CG 2301 IRIG TEMPERATURE"
- Add Paragraph 6.2.1.3.8.4.1 as follows:
- 6.2.1.3.8.4.1 The IRIG TEMP on the CRT shall be monitored at 15 min, 1 hour, and 2 hours after 6.2.1.3.8.2 is executed to insure that the IRIG TEMP (CG 2301) is within ± 3.0 degrees of the PIPA Temperature.
- Change 7 Paragraph 6.1.1.6, add item "f" as follows:
- "f" The TRACKER switch on G&N Indicator Control Panel shall be set to OFF.

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- Change 8 Replace paragraph 6.2.3.1.2 with the following:
- 6.2.3.1.2 Switches and selectors on the G&N Indicator control panel shall be set as follows:
- a. OPTICS MODE to MANUAL
 - b. CONTROLLER COUPLING to DIRECT
 - c. CONTROLLER SPEED to MED
 - d. TELESCOPE TRUNNION to SLAVE to SXT
 - e. RETICLE BRIGHTNESS to minimum brightness position.
- Change 9 Replace paragraph 6.2.3.2.3.2 with the following:
- 6.2.3.2.3.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE on the G&N Indicator Control Panel to ZERO. Wait 15 seconds.
- Change 10 Replace paragraph 6.2.5.1.2 with the following:
- 6.2.5.1.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the following switches on the G&N Indicator Control Panel to the positions designated:
- a. OPTICS MODE to ZERO
 - b. CONTROLLER MODE to DIRECT
 - c. CONTROLLER SPEED to LO
 - d. TELESCOPE TRUNNION to SLAVE to SXT
 - e. RETICLE BRIGHTNESS to minimum brightness position.
- Change 11 Replace paragraph 6.2.5.2.1 with the following:
- 6.2.5.2.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set or verify the following G&N Indicator Control Panel switches to the positions indicated.
- a. CONDITION LAMPS to ON
 - b. OPTICS MODE to ZERO
 - c. CONTROLLER COUPLING to DIRECT
 - d. CONTROLLER SPEED to LO
 - e. TELESCOPE TRUNNION to SLAVE to SXT
 - f. RETICLE BRIGHTNESS to minimum brightness position.
- Change 12 Replace paragraph 6.2.9.23 with the following:
- 6.2.9.23 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to CMC.
- Change 13 Replace sections 6.2.10 and 6.2.11 with the following:
- 6.2.10 Zero Optics Test
- 6.2.10.1 Set the G&N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.

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NOTE: Proceed with this test if 6.2.3 Operate Power on Test has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 Turn On Procedure before proceeding.

INITIALIZATION

- 6.2.10.2 Insure that the following switches on the G&N Indicator Control Panel are set as follows:
- a. TELESCOPE TRUNNION to SLAVE to SXT
 - b. CONTROLLER COUPLING to DIRECT
 - c. CONTROLLER SPEED to HI
 - d. OPTICS MODE to MAN
- 6.2.10.3 Monitor the Optics CDU's by entering VERB 16 NOUN 91 into K-148. Press the ENTER pushbutton
- 6.2.10.4 CAUTION: See Paragraph 5.1.2.11 before proceeding Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Verify the Optics have zeroed properly by observing the following on R1 and R2 of the CRT.
- a. $R1 = +0.00^\circ +0.02^\circ, -0.03^\circ$ (Shaft Angle)
 - b. $R2 = +0.000^\circ +0.006^\circ, -0.007^\circ$ (Trunnion Los Angle)
- 6.2.10.4.1 Enter the following:
- VERB 01 NOUN 10 ENTER
00133 ENTER
Verify R1 = XXX6X
- 6.2.10.4.2 Set the OPTICS MODE switch to CMC. Enter the following:
- ENTER
00033, ENTER
Verify R1 = XXX5X
- OPTICS TIME TO ZERO TEST
- 6.2.10.5 Deleted.

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6.2.10.6 Deleted.

6.2.10.7 Deleted.

6.2.10.8 Deleted.

6.2.10.9 Deleted.

6.2.10.10 Deleted.

6.2.10.11 Deleted.

6.2.10.12 Insert the Inflight Tool (V36601405) into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eyepiece while turning the tool until the TPAC reads +5°. Remove the tool from the trunnion tool input.

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- 6.2.10.13 Insert the Inflight Tool (V36601405) into the Shaft Tool Input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to -3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool.
- 6.2.10.14 Insert the Inflight Tool (V36601405) into the Trunnion Tool input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool.
- 6.2.11 OPTICS Coordinate Transformation Control Test.
- 6.2.11.1 Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.
- NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding.
- INITIALIZATION
- 6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.
- a. TELESCOPE TRUNNION to SLAVE to SXT
 - b. CONTROLLER COUPLING to DIRECT
 - c. CONTROLLER SPEED to HI
 - d. OPTICS MODE to MAN
- 6.2.11.3 Enter the following into the K-Start:
- VERB 16 NOUN 91 ENTR
- 6.2.11.4 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS MODE switch to MAN.
- 6.2.11.5 Set up the analog recorders to monitor the following measurements.
- a. CG 3170 SCT Trunnion Tachometer Output

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RESOLVED MODE PHASING AND IMAGE RATE TEST

- 6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until $R1 = +225.00$ and $R2 = +10.000$ on the CRT and the DSKY's.
- 6.2.11.7 Set the CONTROLLER COUPLING switch on the G&N Panel to RSLV and the CONTROLLER SPEED switch to MED.
- 6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.
- 6.2.11.9 Record time. Quickly displace the OPTICS CONTROL STICK 45 ± 10 degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at 45 ± 10 degrees. When target leaves the SCT upper right field of view press MARK pushbutton. The PROG alarm light shall light.
- 6.2.11.10 From the uplink file tape, the compressed date tape, or the PCM tape, request a data reduction of the shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) and the PROG alarm discrete for the period during which the OPTICS CONTROL STICK was being displaced above. The shaft CDU angle shall be 225 ± 10.00 degrees at the time the PROG alarm occurred. The elapsed time from time at OPTICS CONTROL STICK displacement to the time the PROG alarm discrete is obtained shall be 19 to 32 seconds.

CSC AMPLIFIER SHAFT AND TRUNNION DRIVE TEST

- 6.2.11.11 Set the CONTROLLER COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the Optics until $R = +225.00$ and $R2 = +10.000$. Set the CONTROLLER COUPLING switch to RSLV.
- 6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.
- 6.2.11.13 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the CONTROLLER COUPLING switch on the G&N Panel to DIRECT. Set the OPTICS MODE switch to ZERO. After 15 seconds, return the switch to MAN.

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Change 14

Replace section 6.2.12 with the following:

6.2.12 OPTICS FUNCTIONAL TEST

6.2.12.1 Deleted.

6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:

- a. +28 VDC OPTX OPERATE BUS (CG 1530) is 28.8 ± 3 VDC. Record the indication on the CRT.
- b. CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.
- c. CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT.

6.2.12.3 Deleted.

6.2.12.4 Insure that the Optics Control switches on the G&N Indicator Control Panel are set as follows:

- a. OPTICS MODE to MAN
- b. CONTROLLER SPEED to LO
- c. CONTROLLER COUPLING to DIRECT
- d. TELESCOPE TRUNNION to SLAVE to SXT

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- 6.2.12.5 CAUTION: See Paragraph 5.1.2.11 before proceeding.
Set the OPTICS MODE switch to ZERO. After 15 seconds
return to MAN.
- 6.2.12.6 Resolution Checks
- 6.2.12.6.1 SXT Resolution Check - MSO only.
- 6.2.12.6.1.1 Sight through the SXT eyepiece. Using the OPTICS CONTROL
STICK, adjust the SXT to obtain the best reflected field of
view of the 5-inch autocollimator reticle engravings at the
center of view.
- 6.2.12.6.1.2 Note that the autocollimator reticle contains a series of lines
of different thickness and width. Each set of lines is marked
with a number (20, 15, 10, 7, 5, 3) which indicates the angle
subtended by one line and one space. View each set of lines to
determine the lowest numbered set in which resolution between
lines (ability to distinguish separate distinct lines within a
set) can be made. Record the number associated with that set
of lines. The SXT resolution shall be at least 10 arc seconds
at the center of the field of view.
- 6.2.12.6.2 SCT Resolution Check.
- 6.2.12.6.2.1 Sight through the SCT EYEPIECE. Using the OPTICS CON-
TROL STICK adjust the SCT to obtain the best view of the SCT
RESOLUTION CHART held in the Optics line of sight.
- 6.2.12.6.2.2 Note the chart contains sets of lines. View each set of lines
to determine the lowest numbered set in which the resolution
between lines (ability to distinguish separate lines within a
set) can be made. The SCT shall have a resolution of at least
3 arc minutes at the center of the field of view.
- 6.2.12.7 Slave Telescope Mode Checks
- 6.2.12.7.1 Verify/perform OPTICS POWER ON TEST per paragraph
6.2.3.2.
- 6.2.12.7.2 Set/Verify following switches on G&N INDICATOR CONTROL
PANEL:
- a. TELESCOPE TRUNNION - SLAVE to SXT
 - b. CONTROLLER COUPLING - DIRECT
 - c. CONTROLLER SPEED - HI

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- 6.2.12.7.3 Monitor OCDU's by entering VERB 16 NOUN 91 into K-148.
Press ENTER.
- 6.2.12.7.4 Set OPTICS MODE to MAN
- 6.2.12.7.5 Using the Optics Hand Controller drive the optics until:
R1 = +010.00±001.00 (SHAFT)
R2 = +10.000±01.000 (TRUNNION)
- 6.2.12.7.6 Verify on the CRT and Optics Panel:
SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.7 Set the TELESCOPE TRUNNION on the G&N INDICATOR
CONTROL PANEL to 0°.
- 6.2.12.7.8 Verify:
SHAFT TPAC = R1 ±0.11 DEG
TRUN TPAC = 0.0° ±0.22 DEG
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.9 Set the TELESCOPE TRUNNION on the G&N INDICATOR
CONTROL PANEL to OFFSET 25°.
- 6.2.12.7.10 Verify on CRT and Optics Panel:
SHAFT TPAC = R1±0.11 DEG
TRUN TPAC = 25° ±1.00 DEG
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.11 On the G&N INDICATOR CONTROL PANEL set the TELESCOPE
TRUNNION to SLAVE to SXT.
- 6.2.12.7.12 Verify on CRT and Optics Panel:
SHAFT TPAC = R1±0.11 DEG
TRUN TPAC = R2±0.22 DEG
- 6.2.12.7.13 CAUTION: See Paragraph 5.1.2.11 before proceeding. On
the G&N INDICATOR CONTROL PANEL set the OPTICS MODE
to ZERO. Wait 15 seconds.
- 6.2.12.7.14 Verify on CRT and OPTICS PANEL:
R1 = 000.00 +000.02, -000.03
R2 = 00.000 +00.006, -00.007°
SHAFT TPAC = R1±0.11 DEG
TRUN TPAC = R2±0.22 DEG
- 6.2.12.7.15 If Optics testing will not be continued, set the G&N POWER-
OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.8 SXT Parallelism Tests

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- 6.2.12.8.1 Remove the plug from the base of the SXT eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light.
- NOTE: If needed to reduce external light, place a photographers hood over the optics head.
- 6.2.12.8.2 EXT Auto Collimator Parallelism Test - MSO only
- 6.2.12.8.2.1 Using the OPTICS CONTROL STICK drive the SXT StLOS Trunnion to $+15.00^\circ \pm 2^\circ$ as indicated in R2 of the DSKY. Maintain a Shaft CDU angle of 000.00 ± 0.10 degree.
- 6.2.12.8.2.2 Sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to superimpose the SXT LLOS horizontal reticle image upon the autocollimator horizontal filar. Record the autocollimator reading.
- 6.2.12.8.2.3 Repeat 6.2.12.8.2.2 twice. Calculate and record the average of the three autocollimator readings.
- 6.2.12.8.2.4 Set the OPTICS MODE switch to ZERO. After 15 seconds return the OPTICS MODE switch to MAN.
- 6.2.12.8.2.5 Again sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to bring the SXT StLOS horizontal reticle and autocollimator horizontal filar images to coincide. Record the autocollimator reading.
- 6.2.12.8.2.6 Repeat 6.2.12.8.2.5 twice. Calculate and record the average of the three autocollimator readings. The average value obtained here shall not differ from that obtained in 6.2.12.8.2.3 by more than 10 arc seconds.
- 6.2.12.8.3 Deleted.
- 6.2.12.8.3.1 Deleted.
- 6.2.12.8.3.2 Deleted.

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- 6.2.12.8.3.3. Deleted.
- 6.2.12.8.3.4. Deleted.
- 6.2.12.9. SXT, CMC FUNCTION CHECK
- 6.2.12.9.1. CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. After 15 seconds, return the switch to MAN.
- 6.2.12.9.2. Sight through the SXT. Using the Control Stick align the SXT StLOS with Optical Target No. 1.
- 6.2.12.9.3. When aligned record the value of Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.4. Sight through the SXT. Using the Control Stick align the SXT StLOS with Optical Target No. 2.
- 6.2.12.9.5. When aligned, record the value of Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.6. CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. After 15 seconds set the switch to MAN, then CMC.
- 6.2.12.9.7. Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.3 into the DSKY and press ENTER. Enter the value for Trunnion from 6.2.12.9.3 into the DSKY and press ENTER.
- 6.2.12.9.8. Sight through the SXT. The StLOS should be approximately centered on the Optical Target No. 1. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.3 shall be less than 0.06 degree for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.9. Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton. Enter the value for Trunnion from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton.

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6.2.12.9.10 Sight through the SXT. The StLos should be approximately centered on the Optical Target No. 2. Press the MARK push-button and record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.

6.2.12.9.11 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds.

6.2.12.9.12 If OPTICS testing will not continue, set the G&N Power Optics Switch on the LEB Lighting Panel to OFF.

Change 15

Replace Section 6.2.13 with the following:

6.2.13 Optics Slew Rate Test

6.2.13.1 Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following signals on the CRT.

- a. +28 VDC OPTICS OPERATE BUS (CG 1530) is +29.0 \pm 3.0 VDC
- b. OPTX 28V 800 cps 1% 0° ph not flashing on the CRT
- c. OPTX 28V 800 cps 5% -90° not flashing on CRT

6.2.13.1.1 Verify and/or set the following switches on the G&N Indicator Control Panel to the positions indicated.

- a. TELESCOPE TRUNNION to SLAVE to SXT
- b. CONTROLLER COUPLING to DIRECT
- c. CONTROLLER SPEED to HI
- d. OPTICS MODE to MAN
- e. TRACKER to OFF

6.2.13.2 Monitor the OCDU's by entering VERB 16 NOUN 91 into K148. Press the ENTER pushbutton. Insure RECORD DSKY and RECORD DOWNLINK of R-145 are on.

TRUNNION SLEW RATE - HIGH SPEED

6.2.13.3 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS MODE switch on the G&N Indicator Panel to MAN.

6.2.13.3.1 During the Trunnion Slew Rate Test monitor and verify the following signals:

| Signals | Requirement |
|--|---------------------|
| a. SXT TRUNNION TACH O/P (CG 3150), FQ 3.3 \pm 1.3 VRMS | |
| b. SCT TRUNNION TACH O/P (CG 3170), FQ -0.85 \pm 0.35 VRMS | |
| c. SCT Trunnion Servo Error in Phase (CG3118) | |
| | -0.25 to -2.00 VRMS |

NOTE: Read and understand 6.2.13.4 before proceeding. Do not hold Control Stick at upper limit more than 10 seconds or exceed a trunnion angle of 85°.

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- 6.2.13.4 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 7 seconds release the control stick.
- 6.2.13.5 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape request a data reduction of the Trunnion CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the slew rate test was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Trunnion slew rate shall be 10.0 ± 2.0 deg/sec.
- SHAFT SLEW RATE - HI SPEED
- 6.2.13.6 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.
- 6.2.13.6.1 During the Shaft Slew Rate Test monitor and verify the following signals:
- | Signal | Requirements |
|--|-------------------------|
| a. SXT SHAFT TACHO/P (CG 3140), FQ | 3.3 ± 1.3 VRMS |
| b. SCT SHAFT TACH O/P (CG 3160), FQ | -3.3 ± 1.3 VRMS |
| c. SXT Shaft Servo Error Inphase (CG 3117) | -0.25 to -2.00 VRMS |
- NOTE: Read and understand step 6.2.13.7 before proceeding.
Do not hold Control Stick at right limit for more than 10 seconds or exceed a shaft angle of 250° .
- 6.2.13.7 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 7 seconds release the control stick.
- 6.2.13.8 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 7 second period during which the slew rate was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Shaft slew rate shall be 19.5 ± 3.9 deg/sec.
- TRUNNION SLEW RATE - MED SPEED.
- 6.2.13.9 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the OPTICS CONTROLLER SPEED switch to MED.

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NOTE: Read and understand 6.2.13.10 before proceeding.
Do not hold control stick at upper limit for more than 20 seconds.

- 6.2.13.10 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.
- Record the SXT TRUN MTR Control Winding (CG 3155) and SXT TRUN TACH (CG 3150) signals while slewing the Optics. CG 3155 shall be ± 0.25 to ± 2.00 VRMS. CG 3150 shall be $\pm 0.33 \pm 0.13$ VRMS.
- 6.2.13.11 Perform the following calculations:
- From the uplink file tape the compressed data tape, or the PCM tape, request a data reduction of the Trunnion CDU registers (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the rate test was being performed.
- Calculate the rate by dividing the Δ CDU angle by the elapsed time.
- The Trunnion slew rate shall be 1.0 ± 0.2 deg/sec.
- SHAFT SLEW RATE - MED SPEED
- 6.2.13.12 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set OPTICS MODE switch to MAN.
- NOTE: Read and understand 6.2.13.13 before proceeding.
Do not hold control stick at the right limit for more than 20 seconds.
- 6.2.13.13 Record time. Push and hold the Optics Control Stick to its right limit. After approximately 12 seconds release the control stick.
- Record the SXT SHAFT MTR Control Winding (CG 3145) and SXT Shaft Tach (CG 3140) signals while slewing the Optics. CG 3145 shall be ± 0.50 to ± 4.00 VRMS. CG 3140 shall be 0.33 ± 0.13 VRMS.
- 6.2.13.14 Perform the following calculations:
- From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) for the 12 second period during which the rate test was being performed.

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Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Shaft slew rate shall be 2.00 ± 0.4 deg/sec.

TRUNNION SLEW RATE - LO SPEED

- 6.2.13.15 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Set the CONTROLLER SPEED switch to LO.

- 6.2.13.15.1 During the Trunnion Slew Rate Test monitor and verify the following signals:

| Signal | Requirement |
|---|-------------|
| a. TRUNNION CDU FINE ERROR (CG 3001), FQ $\pm .07$ VRMS MAX | |

NOTE: Read and understand 6.2.13.16 before proceeding. Do not hold control stick at upper limit for more than 20 seconds.

- 6.2.13.16 Record time. Push and hold the Optics Control Stick to its upper limit. After approximately 12 seconds release the control stick.

- 6.2.13.17 Perform the following calculations:

From the uplink file tape, the compressed data tape or the PCM tape, request a data reduction of the Trunnion CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the slew rate test was being performed.

Calculate the rate by dividing the Δ CDU angle by the elapsed time.

The Trunnion Slew Rate shall be 0.10 ± 0.02 deg/sec.

SHAFT SLEW RATE - LO SPEED

- 6.2.13.18 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN.

- 6.2.13.18.1 During the Shaft Slew Rate test monitor and verify the following signal:

| Signal | Requirement |
|---|-------------|
| a. SHAFT CDU FINE ERROR (CG 3021) FQ $\pm .07$ VRMS MAX | |

NOTE: Read and understand 6.2.13.19 before proceeding. Do not hold control stick at right limit for more than 20 seconds.

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- 6.2.13.19 Record time. Push and hold the Optics Control stick to its right limit. After approximately 12 seconds release the control stick.
- 6.2.13.20 Perform the following calculations:
From the uplink file tape the compressed data tape or the PCM tape request a data reduction of the CDU register (address 35) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 12 second period during which the slew rate test was being performed.
Calculate the rate by dividing the Δ CDU angle by the elapsed time.
The Shaft Slew Rate shall be 0.20 ± 0.04 deg/sec.
OPTICS HAND CONTROLLER DRIFT RATE CHECK - LO SPEED
- 6.2.13.21 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. Wait 15 seconds. Set the OPTICS MODE switch to MAN. Record time. Wait 60 seconds.
- 6.2.13.22 Perform the following calculations:
From the uplink file tape, the compressed data tape or the PCM tape request a data reduction of the Trunnion and Shaft CDU registers (addresses 35 and 36 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 60 second period during which the drift rate test was being performed.
Calculate the drift rates by dividing the Δ CDU angle by the elapsed time.
The Trunnion drift rate shall be less than .0167 deg/sec.
The Shaft drift rate shall be less than .0333 deg/sec.
- 6.2.13.23 If OPTICS testing will not continue, set the G/N Power-Optics switch on the LEB Lighting Control Panel to OFF.
- Change 16 Replace Paragraph 6.2.17.5 with the following:
- 6.2.17.5 CAUTION: See Paragraph 5.1.2.11 before proceeding. On the G&N Indicator Control Panel set the following switches to the position indicated.
- TELESCOPE TRUNNION to SLAVE to SXT
 - CONTROLLER COUPLING to DIRECT
 - CONTROLLER SPEED to LO
 - OPTICS MODE to ZERO.

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- Change 17 Replace paragraph 6.2.17.20 with the following:
- 6.2.17.20 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS MODE switch to ZERO. After 15 seconds return the switch to MAN. Enter VERB 33, ENTER into the DSKY.
- Change 18 In Paragraphs 6.2.18.6.1, 6.2.18.6.10, 6.2.18.6.11 and 6.2.18.6.13, change the nomenclature of switches on the G&N Indicator as follows:
- 6.2.18.6.1 From: OPTICS ZERO switch
To: OPTICS MODE switch
- 6.2.18.6.10 From: OPTICS SPEED switch
To: CONTROLLER SPEED switch
- 6.2.18.6.11 From: OPTICS SPEED switch
To: CONTROLLER SPEED switch
- 6.2.18.6.13 From: OPTICS ZERO switch
To: OPTICS MODE switch
- Change 19 Replace paragraphs 6.2.20.3.2, 6.2.20.3.22, and 6.2.20.3.29 and replace with the following:
- 6.2.20.3.2 Set the OPTICS MODE selector on the Indicator Control panel to MAN.
- 6.2.20.3.22 Set the OPTICS CONTROLLER SPEED switch on the Indicator Control Panel to HI.
- 6.2.20.3.29 Set the OPTICS MODE switch on the Indicator Control panel to ZERO for 30 seconds then return to MAN.

ADDENDUM IV

SCOPE: The following changes are required to make ND1002348 applicable as G&N system technical support documentation for systems containing the Restart Monitor package as defined on drawing P/N 2898989.

Change 1: Add the following paragraphs after Paragraph 5.13.5:

5.13.6 If a CMC RESTART or CMC WARNING occurs, the following entries should be made on the DSKY or K-148:

VERB 01 NOUN 10 ENTR
00077 ENTR

Record DSKY Row 1

VERB 21 NOUN 10 ENTR
00077 ENTR
00000 ENTR

5.13.6.1 The contents of Row 1 should be interpreted as follows:

| <u>Alarm Source</u> | <u>Channel 77 Code (Octal)</u> |
|-------------------------------|------------------------------------|
| ** *Parity Fail (F Memory) | 001 |
| ** *Parity Fail (E Memory) | 003 |
| ** TC Trap | 004 |
| ** Rupt Lock | 010 |
| ** Nightwatchman | 020 |
| *** Voltage Fail | 040 |
| Counter Fail | 100 |
| Scaler Fail | 200 |
| Scaler Double Frequency Alarm | 400 |

*NOTE: Parity Fail will either be in E or F Memory, but not in combination.

**NOTE: There is a possibility that a Counter Fail Alarm will also occur, depending on when the alarm occurs, in which case Bit 7 will also be set.

***NOTE: Other alarms will probably occur before the Voltage Fail Alarm occurs, in which case the contents of Channel 77 will contain the octal sum of all the alarms, but it will contain the Voltage Fail code.

Change 2: Add the following paragraph after Paragraph 6.2.1.3.8.1:

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6.2.1.3.8.1.1 If a RESTART occurs in the step above, enter the following on K-148:

VERB 21 NOUN 10 ENTR
00077 ENTR
00000 ENTR

Change 3: Replace Paragraphs 6.2.2.6 through 6.2.2.10.5 with the following:

6.2.2.6 Alarms and Interrupts Test with Restart Monitor

6.2.2.6.1 Verify the appropriate K-START Tape for ALMS & INT TEST/RSTRT
MON is on the K-START Tape Reader.

6.2.2.6.2 Start the Tape Reader.

6.2.2.6.3 When the Tape Reader stops, verify:

R1 = +08282
R2 = +10550
R3 = -000ZX (X is the tape revision number and
Z is the revision number to the rope revision.)

6.2.2.6.4 Start the Tape Reader.

6.2.2.6.5 When the Tape Reader stops, verify:

R1 = 00100

6.2.2.7 Parity Fail Test

6.2.2.7.1 Start the Tape Reader.

6.2.2.7.2 When the Tape Reader stops, verify the following:

(a) On the DSKY, the RESTART lamp is lit.
(b) The PGNS Caution lamp is lit.
(c) R1 = 00001 or 00101.

6.2.2.7.3 On the DSKY, press the RSET pushbutton. Verify RESTART AND
PGNS Caution lamps are not lit.

6.2.2.7.4 Start the Tape Reader.

6.2.2.7.5 When the Tape Reader stops, verify:

R1 = 00101

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- 6.2.2.7.6 Start the Tape Reader
- 6.2.2.7.7 When the Tape Reader stops, verify:
R1 = 00200
- 6.2.2.8 Rupt Lock Test
- 6.2.2.8.1 Start the Tape Reader
- 6.2.2.8.2 When the Tape Reader stops, verify the following:
 - (a) On the DSKY, the RESTART and PROG Caution lamps are lit.
 - (b) The PGNS Caution lamp is lit.
 - (c) R1 = 00010 or 00110.
- 6.2.2.8.3 On the DSKY, press the RSET pushbutton. Verify the RESTART, PROG and PGNS Caution lamps are not lit.
- 6.2.2.8.4 Start the Tape Reader.
- 6.2.2.8.5 When the Tape Reader stops, verify:
R1 = 00201.
- 6.2.2.8.6 Start the Tape Reader.
- 6.2.2.8.7 When the Tape Reader stops, verify:
R1 = 00300
- 6.2.2.9 TC Trap Test
- 6.2.2.9.1 Start the Tape Reader
- 6.2.2.9.2 When the Tape Reader stops, verify the following:
 - (a) On the DSKY, the RESTART and PROG Caution lamps are lit.
 - (b) The PGNS Caution lamp is lit.
 - (c) R1 = 00004 or 00104.
- 6.2.2.9.3 On the DSKY, press the RSET pushbutton. Verify the RESTART, PROG and PGNS Caution lamps are not lit.

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| | |
|------------|--|
| 6.2.2.9.4 | Start the Tape Reader. |
| 6.2.2.9.5 | When the Tape Reader stops, verify: R1 = 00301 |
| 6.2.2.9.6 | Start the Tape Reader |
| 6.2.2.9.7 | When the Tape Reader stops, verify the following: (a) On the DSKY, the RESTART and PROG Caution lamps are lit. (b) The PGNS Caution lamp is lit. (c) R1 = 00004 or 00104. |
| 6.2.2.9.8 | On the DSKY, press the RSET pushbutton. Verify the RESTART, PROG and PGNS Caution lamps are not lit. |
| 6.2.2.9.9 | Start the Tape Reader. |
| 6.2.2.9.10 | When the Tape Reader stops, verify: R1 = 00302 |
| 6.2.2.9.11 | Start the Tape Reader. |
| 6.2.2.9.12 | When the Tape Reader stops, verify: R1 = 00400 |
| 6.2.2.10 | Nightwatchman Test |
| 6.2.2.10.1 | Start the Tape Reader |
| 6.2.2.10.2 | When the Tape Reader stops, verify the following: (a) The RESTART and PROG Caution lamps on the DSKY are lit. (b) The PGNS Caution lamp is lit. (c) R1 = 00020 or 00120. |
| 6.2.2.10.3 | On the DSKY, press the RSET pushbutton. Verify the RESTART, PROG and PGNS Caution lamps are not lit. |
| 6.2.2.10.4 | Start the Tape Reader. |

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6.2.2.10.5 When the Tape Reader stops, press KEY RELEASE and verify:
R1 = 00401

Change 4: Add the following to Paragraph 6.2.19.10:
On K-148, enter the following sequence:
VERB 01 NOUN 10 ENTR
00077 ENTR
Verify the DSKY Row 1 display has Bit 6 ON. Other combinations of bits are permissible, but Bit 6 must be present.

Change 5: Revise Paragraph 6.2.19.11 as follows:
6.2.19.11 On the PSAAM, place the INHIBIT VOLTAGE FAIL switch to ON.
On the DSKY, enter the following:
VERB 21 NOUN 10 ENTR
00077 ENTR
00000 ENTR
PRESS RSET
VERB 21 NOUN 27 ENTR
77777 ENTR

Change 6: Add the following to Paragraph 6.2.19.17:
On K-148, enter the following:
VERB 01 NOUN 10 ENTR
00077 ENTR
Verify the DSKY Row 1 display has Bit 6 ON. Other combinations of bits are permissible, but Bit 6 must be present.

Change 7: Revise Paragraph 6.2.19.18 as follows:
6.2.19.18 On the PSAAM, place the INHIBIT VOLTAGE FAIL switch to ON.
On the DSKY, enter the following:
VERB 21 NOUN 10 ENTR
00077 ENTR
00000 ENTR
PRESS RSET
VERB 21 NOUN 27 ENTR
77777 ENTR

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Change 8: Add the following to Paragraph 6.2.19.24:
On K-148, enter the following:
VERB 01 NOUN 10 ENTR
00077 ENTR
Verify the DSKY Row 1 display has Bit 6 ON. Other combinations of bits are permissible but Bit 6 must be present.

Change 9: 6.2.19.25 Revise Paragraph 6.2.19.25 as follows:
On the PSAAM, place the INHIBIT VOLTAGE FAIL switch to ON.
On the DSKY, enter the following:
VERB 21 NOUN 10 ENTR
00077 ENTR
00000 ENTR
PRESS RSET
VERB 21 NOUN 27 ENTR
77777 ENTR

Change 10: Add the following to Paragraph 6.2.19.36:
On K-148, enter the following:
VERB 01 NOUN 10 ENTR
00077 ENTR
Verify the DSKY Row 1 display has Bit 6 ON. Other combinations of bits are permissible, but Bit 6 must be present.

Change 11: Add the following to Paragraph 6.2.19.31:
On the DSKY, enter the following:
VERB 01 NOUN 10 ENTR
00077 ENTR
Verify the DSKY Row 1 display has Bit 6 ON. Other combinations of bits are permissible, but Bit 6 must be present.

Change 12: 6.2.19.33 Revise Paragraph 6.2.19.33 as follows:
Terminate CMC Self-Check by inserting into K-148:
VERB 21 NOUN 10 ENTR
00077 ENTR
00000 ENTR
PRESS RSET
VERB 21 NOUN 27 ENTR
00000 ENTR

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POST INSTALLATION CHECKOUT PROCESS
 SPECIFICATION FOR THE APOLLO GUIDANCE &
 NAVIGATION SYSTEM BLOCK II-KSC

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This specification consists of page 1 to 152 inclusive.

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|-----------|---------|---------------|-----------|--------------|
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| | | MIT/IL | | ACSP |

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5.12.1 The APOLLO G&N System shall interface with accepted ECS and EPS distribution systems for power and environment control purposes and with the SCS or SCS substitute system for signal interface in accordance with the applicable ICD's.

5.13 General System Operating characteristics.

5.13.1 The program does not automatically display computer error codes when a PROG alarm occurs. If error code is desired enter the following on K-148 and then observe the DSKY display.

VERB 05 NOUN 09 ENTR

R1 = FAILREG
R2 = FAILREG +1
R3 = FAILREG +2

5.13.2 The DSKY "NO ATT" lamp illuminates any time the system is in the Coarse Align Mode, IMU Cage, or during turn on.

5.13.3 Tracker Fail lamp may light after optics power turn on. Press the Error Reset to extinguish.

5.13.4 The CMC warning light may come on for approximately 20 seconds when +28 VDC CMC Operate Power is applied; if the MASTER ALARM light illuminates, push to reset.

5.13.5 When coming out of AGC STBY, if the Standby lamp does not extinguish when the PRO pushbutton is pressed, repeatedly press the PRO pushbutton until the Standby lamp does extinguish. Record the number of times it was necessary to press the PRO pushbutton. No more than three depressions of the PRO pushbutton shall be required to turn the STBY lamp off.

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6.0 DETAIL REQUIREMENTS

6.1 Initial Test Conditions

6.1.1 The following precautions shall be observed to preclude loss of continuity in inertial component performance history of the IMU. Deviation may necessitate recalibration of the inertial components.

6.1.1.1 The IMU shall be supplied with heater power on a continuous basis. When S/C Ground Power Supply, Model No. C14-418 is not providing heater power, then the heater power shall be supplied through the Portable Temperature Controller (PTC) Model No. 823-011. The temperature of the IRIG's shall be maintained between 120° and 150°F. The temperature of the PIPA's shall be maintained between 115° and 145°F.

6.1.1.2 The Standby Mode is identified by the circuit breakers IMU HTR MN A, IMU HTR MN B, COMPUTER MN A and MN B in the ON position and the G&N Power-IMU switch on LEB Lighting Control Panel in the OFF position. The Operate Mode is identified by the circuit breaker IMU HTR MN A, MN B, COMPUTER MN A and MN B in the ON position and the G&N Power-IMU switch on the LEB Lighting Control Panel in the ON position. The G&N System shall be operating in the Standby Mode with CMC power ON for a minimum of two hours prior to advancing to the IMU Operate Mode. In the event Standby or CMC power is interrupted, an equivalent time period, but not less than 15 minutes, shall be allowed when power is restored before advancing to the Operate Mode, except that when the interval of interruption exceeds two hours, a two-hour warmup period shall be mandatory (exceptions to the 2-hour warmup are noted in 6.2.5.2).

6.1.1.3 The Inertial Measurement Unit shall not be without heater power for more than 15 minutes.

6.1.1.4 During the turn on of the G&N power, COMPUTER MN A and MN B and IMU HTR MN A and IMU HTR MN B circuit breakers must be turned on before the IMU MN A and IMU MN B circuit breakers on the Right Hand Circuit Breaker Panel of the CM. During the turn off of the G&N power the IMU MN A and IMU MN B circuit breakers must be turned off before the IMU HTR MN A and IMU HTR MN B circuit breakers on the Right Hand Circuit Breaker Panel of the CM. In no case shall COMPUTER MN A and MN B circuit breakers be turned off before IMU MN A and MN B circuit breakers or G/N POWER-IMU switch.

6.1.1.5 A warmup period of 1 hour with OPERATE power applied shall be required prior to performing any test in which gyro and accelerometer parameters are measured, and 15 minutes warmup prior to any test in which precision amplitude and frequency power supply checks are made.

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- 6.1.1.6 The following Command Module switches shall be in the position shown unless specifically directed otherwise in a procedural function.
- a. UP TLM switches on the LEB G&N Control Panel and MDC Panel 2 shall be set to ACCEPT.
 - b. LAUNCH VEHICLE - GUIDANCE switch on MDC Panel 2 shall be set to IU.
 - c. The SC CONT switch on MDC Panel 1 shall be set to CMC.
 - d. The CMC MODE switch on MDC Panel 1 shall be set to AUTO.
 - e. The ΔV CG switch on MDC Panel 1 shall be set to CSM.
 - f. The LIGHTS-INTEGRAL control on the LEB Lighting Control Panel and the Left Hand Circuit Breaker panel shall be set to the minimum brightness - OFF position.
- 6.1.2 The following optical reference alignment requirements shall be demonstrated - MSO only.
- 6.1.2.1 G&N Installation Qualification Fixture.
- 6.1.2.1.1 The SXT Optical Reference NO. 1 (Azimuth Autoset) LOS shall be located approximately 40 degrees (CW when viewed from above) from the S/C Z axis measured in a horizontal plane. At this position, the Optical Reference shall be capable of being viewed through the SXT ST LOS.
- 6.1.2.1.2 The SXT Optical Reference LOS position with respect to the horizontal plane shall be known to within 5 arc-seconds. The azimuth bearing of the Optical Reference LOS shall be known to within ± 30 minutes of arc.
- 6.1.2.1.3 The SXT Optical Reference NO. 2 LOS shall be located approximately 80 degrees from the SXT Optical Reference No. 1 (40 degrees from S/C Z axis) measured in a horizontal plane. At this position, the Optical Reference shall be capable of being viewed through the SXT STAR LOS.
- 6.1.2.1.3.1 The SXT optical reference LOS position with respect to the horizontal plane shall be known to within 5 arc-seconds. The azimuth bearing of the Optical Reference LOS shall be known to within ± 30 minutes of arc.
- 6.1.2.1.4 SXT Optical Reference No. 3 shall be capable of being viewed through the SXT LLOS and the STAR LOS simultaneously at the Zero Optics position.
- 6.1.2.1.4.1 SXT Optical Reference No. 3 shall have the capability to measure the non-parallelism of the LLOS and STAR LOS to a resolution of 2-arc-seconds.

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- 6.2.2.7.4 Start the Tape Reader.
- 6.2.2.7.5 When the Tape Reader stops, verify:
R1 = 00101
- 6.2.2.7.6 Start the Tape Reader
- 6.2.2.7.7 When the Tape Reader stops, verify:
R1 = 00200
- 6.2.2.8 Rupt Lock Test
(Too Frequent)
- 6.2.2.8.1 Start the Tape Reader
- 6.2.2.8.2 When the Tape Reader stops, verify the following:
(a) On the DSKY, the RESTART and PROG Caution lamps are lit.
(b) The PGNS Caution lamp is lit.
(c) R1 = 00010 or 00110.
- 6.2.2.8.3 On the DSKY, press the RSET pushbutton. Verify the RESTART, PROG and PGNS Caution lamps are not lit.
- 6.2.2.8.4 Start the Tape Reader.
- 6.2.2.8.5 When the Tape Reader stops, verify:
R1 = 00201.
(Too Infrequent)
- 6.2.2.8.5.1 Start the Tape Reader.
- 6.2.2.8.5.2 When the Tape Reader stops, verify the following:
(a) The RESTART lamp on the DSKY is lit.
(b) The PGNS Caution lamp is lit.
(c) R1 = 00010 or 00110.
- 6.2.2.8.5.3 On the DSKY, press the RSET pushbutton. Verify the RESTART and PGNS Caution lamps are not lit.
- 6.2.2.8.6 Start the Tape Reader.
- 6.2.2.8.7 When the Tape Reader stops, verify:
R1 = 00300

6.2.3.1.11 Verify that the following secondary power supply voltages are not flashing on the CRT display.

SECONDARY POWER SUPPLY VOLTAGES

| <u>Meas. No.</u> | <u>Signal</u> |
|------------------|----------------------------|
| 1. CG 1040 | +120 VDC PIPA SUPPLY |
| 2. CG 1051 | +20 VDC PIPA SUPPLY |
| 3. CG 1052 | -20 VDC PIPA SUPPLY |
| 4. CG 1070 | +4 VDC CDU SUPPLY |
| 5. CG 1100 | -28 VDC ELECTRONICS |
| 6. CG 1020 | +14 VDC CMC SUPPLY |
| 7. CG 1030 | +4 VDC CMC SUPPLY |
| 8. CG 1201 | IMU 28V 800 CPS 1 pct 0 ph |
| 9. CG 1202 | IMU 28V 800 CPS 5 pct ph A |
| 10. CG 1203 | IMU 28V 800 CPS 5 pct ph B |
| 11. CG 1331 | 3.2KC 28V SUPPLY |
| 12. CG 1110 | 2.5 VDC TM BIAS |

6.2.3.1.12 The IMU Platform should not be moved during the Temperature Control Test. 15 minutes after the application of IMU OPERATE power record PIPA TEMP (CG 2300) displayed on the CRT.

6.2.3.1.14 1 hour after the application of IMU OPERATE power monitor and record PIPA TEMP (CG 2300) every 5 minutes for 1 hour. Verify that each reading does not deviate from the average of each signal by more than 0.1°F.

6.2.3.1.15 When 2 hours have elapsed since the application of IMU OPERATE power record PIPA TEMP. PIPA TEMP shall be 130.5±1.5°F. PIPA TEMP shall be within 0.5°F of that recorded in 6.2.3.1.12 and 6.2.1.3.8.4.

6.2.3.2 Optics Power ON

6.2.3.2.1 Optics power shall be applied by actuating the G&N OPTICS MN A and OPTICS MN B breakers on the Right Hand Circuit Breaker Panel (breakers pushed in), and placing G/N Power - OPTICS switch on the LEB Lighting Control Panel to ON.

6.2.3.2.2 OPTICS +28 VDC discrete shall be issued (CG 1533). Verify by observing that the OPTICS lamp on Event Module is illuminated. Verify that the +28 VDC OPTX OPERATE BUS (CG 1530) is +28.8±3 VDC. Record the indication on the CRT.

6.2.3.2.3 Verify the following secondary power supply voltages on the CRT are not flashing:

CG 1211 OPTX 28V 800 CPS 1 pct 0 ph
CG 1212 OPTX 800 CPS 5 pct-90 ph

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- 6.2.3.2.3.1 Set/verify OPTICS MODE on the G&N Indicator Control Panel to MAN.
- 6.2.3.2.3.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Panel to ZERO.
- 6.2.3.3 IMU Cage Test
- 6.2.3.3.1 Enter the following into the DSKY:
- a. VERB 40 NOUN 20, ENTER (wait 3 seconds)
 - b. VERB 41 NOUN 20, ENTER
 - c. +00200, ENTER
 - d. +00200, ENTER
 - e. +00200, ENTER
- Observe that the NO ATT lamps on the DSKY's light and that CDUX, CDUY, CDUZ on the CRT indicate approximately +00200.
- 6.2.3.3.2 Set up the Analog Recorder to monitor the following signals:
- a. MG 1X Resolver Output Sine (CG 2112)
 - b. MG 1X Resolver Output Sine (CG 2142)
 - c. OG 1X Resolver Output Sine (CG 2172)
- Start the Analog Recorders.
- 6.2.3.3.3 On MDC panel 1, press and hold the IMU CAGE switch in the CAGE position. On the Analog Recorder, verify that the 1X Sine signals (CG 2112, CG 2142, and CG 2172) null out at 0.5V rms or less.
- 6.2.3.3.4 Release the IMU CAGE switch. Disregard any momentary transients on the 1X Resolver Sine signals when the switch is released. Sustained oscillations shall be cause for immediate removal of IMU OPERATE power.
- 6.2.3.3.5 On the CRT verify that CDUX, CDUY and CDUZ are all between +00150 and +35850.
- 6.2.3.3.6 Stop the Analog Recorders.
- 6.2.4 G&N System Power Supplies Test
- 6.2.4.1 Proceed with this test if 6.2.3, Operate Power On Test, has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding with this test. Insure that the IMU Operate Power has been on for at least 15 minutes before proceeding with this test.

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- 6.2.4.2 Enter the following sequence into the K-Start. Verb 41 NOUN 20, ENTER;
+00000 ENTER; +00000 ENTER; +00000 ENTER.
- 6.2.4.3 Set/Verify the following circuit breakers and switches on the Right Hand
Circuit Breakers Panel and LEB.
- a. COMPUTER MN A to ON (pushed in) and COMPUTER MN B to OFF
(pulled out).
 - b. G/N - POWER to AC1
 - c. IMU HTR MN A to ON (pushed in) and IMU HTR MN B to OFF (pulled out).
 - d. IMU MN A to ON (pushed in) and IMU MN B to OFF (pulled out).
 - e. G/N POWER - IMU to IMU
 - f. OPTICS MN A to ON (pushed in) and OPTICS MN B to OFF (pulled out).
 - g. G/N POWER - OPTICS to OPTICS
- 6.2.4.4 Record the voltage indicated on the CRT for the following signals:
- a. The +28 VDC IMU OPERATE (Buss No. 1) output voltage shall be $+28.8 \pm 3$
VDC (CG 1500).
 - b. The +28 VDC IMU STANDBY (Buss No. 2) output voltage shall be $+28.8 \pm 3$
VDC (CG 1510).
 - c. The +28 VDC CMC OPERATE (Buss No. 3) output voltage shall be $+28.8 \pm 3$
VDC (CG 1520).
 - d. The +28 VDC OPTX OPERATE (Buss No. 4) output voltage shall be $+28.8 \pm 3$
VDC (CG 1530).
 - e. The CG 2221, IGA CDU Coarse Error measurement shall be 0.0 ± 0.68 V rms.
 - f. The CG 2251 MGA CDU Coarse Error measurement shall be 0.0 ± 0.68 V rms.
 - g. The CG 2281 OGA CDU Coarse Error measurement shall be 0.0 ± 0.68 V rms.
- 6.2.4.5 Record the voltage indicated on the CRT for the following power supplies:
- a. The +120 VDC PIPA Power Supply output voltage shall be 120 ± 6 VDC
(CG 1040).
 - b. The +20 VDC PIPA Power Supply output voltage shall be 20.0 ± 1.2 VDC
(CG 1051).
 - c. The -20 VDC PIPA Power Supply output voltage shall be -20 ± 2 VDC
(CG 1052).
 - d. The -28 VDC Electronics Power Supply Output voltage shall be -28.5 ± 6.0
VDC (CG 1100).

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- 6.2.4.6 The following values shall be measured with the guidance reference clock synchronizing input pulse. Record the voltage indicated on the CRT.
- IMU 28V, 800 CPS 1% 0 deg voltage shall be 28.0 ± 0.6 VAC (CG 1201).
 - IMU 28V, 800 CPS, 5% PHA - 90 deg. voltage shall be 28.0 ± 1.4 VAC (CG 1202).
 - IMU 28V, 800 CPS, 5% PHB 0 deg. voltage shall be 28.0 ± 2.1 VAC (CG 1203).
 - Optics 28V, 800 CPS 1% 0 deg voltage shall be 28.0 ± 0.6 VAC (CG 1211).
 - Optics 28V, 800 CPS 5% - 90 deg voltage shall be 28.0 ± 1.5 VAC (CG 1212).
 - PH Diff IMU 5% 0 deg. -90 deg. (CG 1207) phase difference shall be $-90^\circ \pm 10^\circ$.
 - PH Diff Optics 1% IMU 1% (CG 1220) phase difference shall be $0^\circ \pm 10^\circ$.
- 6.2.4.7 Record the voltages indicated on the CRT for the following power supplies:
- The +14 VDC CMC Power Supply output voltage shall be $+14.0 \pm 0.4$ VDC (CG 1020).
 - The +4 VDC CMC Power Supply output voltage shall be $+4.0 \pm 0.2$ VDC (CG 1030).
 - The +4 VDC CDU Power Supply output voltage shall be $+4.0 \pm 0.2$ VDC (CG 1070).
 - The +2.50 VDC TM BIAS SUPPLY output voltage shall be $+2.50 \pm 0.06$ VDC (CG 1110).
- 6.2.4.8 Record the CRT indications for the following measurements:
- The 28V, 3200 CPS Power Supply feedback output voltage shall be 28.6 ± 0.6 V RMS (CG 1331).
 - The phase difference between the 3.2 Kc supply and CMC sync shall be $0^\circ \pm 10^\circ$ (CG 1336).
 - The +14 VDC CMC Power Supply rms noise shall be less than 0.2 vrms (CG 1021).
 - The +4 VDC CMC Power Supply rms noise shall be less than 0.2 vrms (CG 1031).
- 6.2.4.8.1 Enter the following into the K-148:
- ```

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+09000 ENTR
Wait 15 seconds.

```
- 6.2.4.9 Set/Verify the following circuit breakers and switches on the Right Hand Circuit Breaker Panel and LEB:
- G/N POWER-OPTICS to OFF
  - OPTICS MN B to ON (pushed in) and OPTICS MN A to OFF (pulled out)
  - G/N POWER - IMU to OFF
  - IMU MN B to ON (pushed in) and IMU MN A to OFF (pulled out).
  - IMU HTR MN A to OFF (pulled out)
  - G/N - POWER to OFF
  - COMPUTER MN B to ON (pushed in) and COMPUTER MN A to OFF (pulled out)

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- 6.2.4.10 Verify that the +28 VDC CMC OPERATE output voltage is  $\pm 28.8 \pm 3$  VDC (CG 1520).
- 6.2.4.11 Set the G/N - POWER switch on the LEB to AC2. Set the IMU HTR MN B to ON (pushed in). Verify that the +28 VDC IMU STANDBY output voltage is  $\pm 28.8 \pm 3$  VDC (CG 1500).
- 6.2.4.12 Wait until 15 minutes have elapsed since setting G/N POWER - IMU to OFF in 6.2.4.9. c then set the G/N POWER - IMU to IMU. Verify that the +28 VDC IMU OPERATE output voltage is  $\pm 28.8 \pm 3$  VDC (CG 1500).
- 6.2.4.13 Set the G/N POWER - OPTICS to OPTICS. Verify that the +28 VDC OPTX OPERATE output voltage is  $\pm 28.8 \pm 3$  VDC (CG 1530).
- 6.2.4.14 Repeat 6.2.4.5 through 6.2.4.8.
- 6.2.4.15 Set the following circuit breakers to the position indicated:
- a. Set the COMPUTER MN A to ON (pushed in).
  - b. Set the IMU HTR MN A to ON (pushed in).
  - c. Set the IMU MN A to ON (pushed in).
  - d. Set the OPTICS MN A to ON (pushed in).
- 6.2.4.16 Miscellaneous Checks - The following miscellaneous signals are required to supply data for system evaluation in the event of failure, or for trend analysis of system performance. Record the values displayed on the CRT for the following signals.
- a. CG 4300 CMC Temperature
  - b. CG 6020 PIPA Calibration Module Temperature
  - c. CG 6021 IMU 800 CPS 5% Temperature
- 6.2.4.17 Verify and record the following signals displayed on the CRT:
- a. +120 VDC PIPA SUP NOISE RMS shall be less than 1.5 VRMS (CG 1042).
  - b. +20 VDC PIPA SUP NOISE RMS shall be less than 1.0 VRMS (CG 1053).
  - c. +4 VDC CDU SUP NOISE RMS shall be less than 0.1 VRMS (CG 1071).
  - d. +28V IMU OPERATE BUS NOISE RMS shall be less than 1.0 VRMS (CG 1501).
  - e. +28V IMU STANDBY BUS NOISE RMS shall be less than 1.0 VRMS (CG 1511).
  - f. +28V CMC OPERATE BUS NOISE RMS shall be less than 2.0 VRMS (CG 1521).
  - g. +28V OPTX OPERATE BUS NOISE RMS shall be less than 2.0 VRMS (CG 1531).
- 6.2.4.18 The noise peaks of the following signals are demonstrated on the event light when the peaks have a rise time between 2 and 50 usec and the peak voltage exceeds 5 volts.

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- 6.2.4.18(Cont) a. +14V CMC SUPPLY NOISE PEAKS (CG 1022)  
b. +4V CMC SUPPLY NOISE PEAKS (CG 1032)  
c. +120 VDC PIPA SUPPLY NOISE PEAKS (CG 1043)  
d. +4 VDC CDU SUPPLY NOISE PEAKS (CG 1072)  
e. +28V IMU OPERATE BUS NOISE PEAKS (CG 1502)  
f. +28V IMU STANDBY BUS NOISE PEAKS (CG 1512)  
g. +28V CMC OPERATE NOISE PEAKS (CG 1522)  
h. +28V OPTX OPERATE NOISE PEAKS (CG 1532)
- 6.2.4.19 If Optics Testing will not continue, set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.5 General Turn Off and Turn On Procedure
- NOTE: The procedure shall be utilized any time after performing 6.2.1, Standby Power On Test and 6.2.3, Operate Power On Test to turn on or turn off the G&N Systems. Appropriate portions of this procedure will be referenced in other tests.
- 6.2.5.1 Turn Off Procedure.
- CAUTION: This procedure must be performed in the sequence specified. Failure to adhere to this sequence may require calibration of the inertial components.
- 6.2.5.1.1 Enter the following sequence into the K-148.
- a. VERB 41 NOUN 20, ENTER  
b. +00000 ENTR  
c. +00000 ENTR  
d. +09000 ENTR
- Verify that the GIMBAL LOCK indicator on the DSKY's is illuminated. On the G&N Indicator Control Panel verify PGNS light is ON. On the DSKY verify NO ATT light is ON.
- 6.2.5.1.2 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the following switches on the G&N Indicator Control Panel to the positions designated.
- a. OPTICS ZERO to ZERO  
b. OPTICS MODE to MANUAL  
c. OPTICS COUPLING to DIRECT  
d. OPTICS SPEED to MED  
e. OPTICS TEL TRUN to SLAVE to SXT  
f. RETICLE BRIGHTNESS to minimum brightness position

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- 6.2.5.1.3 Set the G/N Power - IMU switch on the LEB Lighting Control Panel to OFF and G&N IMU MN A and MN B circuit breakers on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).
- NOTE: If PROG ALARM 212 occurs, press RSET and continue.
- 6.2.5.1.3.1 On K-148 enter the following:
- |         |         |              |
|---------|---------|--------------|
| VERB 21 | NOUN 01 | ENTER        |
| 00034   |         | ENTER        |
| 00000   |         | ENTER, ENTER |
| 00760   |         | ENTER        |
| 40000   |         | ENTER        |
- Verify that NO ATT and GIMBAL LOCK lamp indications are OFF.
- 6.2.5.1.4 Set the G&N Power AC1-OFF-AC2 Switch on the Right Hand Circuit breaker panel to OFF and the G&N POWER AC1 and AC2 circuit breakers to OFF (breakers pulled out).
- 6.2.5.1.5 Decrease the LIGHTS - NUMERICS controls on both the Left Hand Circuit Breaker panel and the LEB Lighting Control Panel to the minimum brightness - OFF position.
- 6.2.5.1.6 Set the PSAAM power switch on the PSAAM to OFF.
- 6.2.5.1.7 Set the IMU HTR MN A and MN B circuit breaker on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).
- 6.2.5.1.8 Set the G&N POWER - OPTICS switch on the LEB Lighting Control Panel to OFF and G&N OPTICS MN A and MN B breakers on the Right, Hand Circuit breaker panel to OFF.
- 6.2.5.1.9 Set the COMPUTER MNA and MN B Circuit breakers on the Right Hand Circuit Breaker panel to OFF (breakers pulled out).
- 6.2.5.1.10 Verify that the PTC is supplying inertial components heater power to the G&N System. This will be indicated by the following on the PTC.
- G&N ON (PTC inhibit) light not illuminated.
  - IMU Temp/heater current meter indicates IMU temperature of  $130^{\circ}\pm 5^{\circ}\text{F}$ .
- 6.2.5.2 Turn ON Procedure
- 6.2.5.2.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set or verify the following G&N Indicator Control Panel switches to the position indicated.



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- 6.2.5.2.1(Cont) a. CONDITION LAMPS to ON  
b. OPTICS ZERO to ZERO  
c. OPTICS MODE to MANUAL  
d. OPTICS COUPLING to DIRECT  
e. OPTICS SPEED to LO  
f. OPTICS TEL TRUN to SLAVE to SXT  
g. RETICLE BRIGHTNESS to minimum brightness position.
- 6.2.5.2.2 Insure that interfacing system EPS and ECS are turned on and operating properly.
- CAUTION: The remaining procedure must be followed in sequence specified. Failure to adhere to this sequence may require recalibration of the inertial components.
- 6.2.5.2.3 Energize the G&N COMPUTER MN A and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Press the STBY pushbutton on the DSKY for approximately 3 seconds. Verify +14 and +4 VDC AGC power supply outputs on CRT display. Voltages shall be  $+14 \pm 0.4V$  (CG1020) and  $+4 \pm 0.2$  (CG1030). On DSKY verify TEMP light is ON. On the G&N Indicator Control Panel verify PGNS light is ON.
- 6.2.5.2.4 Set the G&N POWER AC1 and AC2 breakers on the Right Hand Circuit Breaker Panel to ON (breakers pushed in). Set the G&N POWER AC1-OFF-AC2 switch to AC1.
- 6.2.5.2.4.1 Set the G&N DSKY and Display Panel brightness to the minimum acceptable level by manipulation of LIGHTS - NUMERICS control on both Left Hand Circuit breaker panel and LEB Lighting Control panel.
- 6.2.5.2.5 Energize the G&N IMU HTR, MN A and MN B breakers on the Right Hand Circuit Breaker panel (breakers pushed in). Insure that the CMC +28 VDC discrete lamp on the Event Module is illuminated (CG 1523). Verify TEMP light on DSKY is extinguished. Verify PGNS light on the G&N Indicator Control Panel is extinguished.
- 6.2.5.2.5.1 Set/Verify the following switches on the PSAAM:
- a. PSAAM POWER to ON  
b. INHIBIT VOLTAGE FAIL to OFF
- 6.2.5.2.6 Enter VERB 36 into K-148. Press ENTER pushbutton. Press ERROR RESET pushbutton on K-148. All computer alarms on the Main Display Console (MDC) and LEB AGC DSKY shall clear. Verify that DSKY R1, R2, R3, VERB, NOUN and PROG indications are blank.
- 6.2.5.2.7 Deleted.

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- 6.2.5.2.8 Initiate CMC self-check by entering the following sequence into the K-148:
- a. VERB 21 NOUN 27, ENTER
  - b. 77777, ENTER
  - c. VERB 15 NOUN 01, ENTER
  - d. 1366, ENTER
- 6.2.5.2.8.1 Monitor DSKY until R2 (SCOUNT +1) increments twice. If an error is detected, the PROGRAM ALARM lamp on the DSKY's shall light.
- 6.2.5.2.8.2 Terminate the monitor routine by entering the following into the DSKY:
- VERB 34, ENTER.
- 6.2.5.2.8.3 Enter the following into the K-148:
- a. VERB 21
  - b. NOUN 27 ENTER
  - c. 00000, ENTER
- NOTE: Allow 2 hours to elapse before proceeding to 6.2.5.2.9 with the following exceptions:
- a. If the G&N System has been in the power off state for less than 5 days with the gimbals in the parked position (0°, 0°, 90°) and the system has not been moved, allow 15 minutes to elapse before proceeding.
  - b. If the G&N System has been turned off with the gimbals in the unparked position for less than 2 hours allow a warmup time equal to the time off but not less than 15 minutes to elapse before proceeding.
- CAUTION: If the requirements of 6.2.5.2.10 are not met, remove IMU Operate Power immediately by setting the G/N POWER-IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.5.2.9 After the required warmup time has elapsed set the G&N IMU MN A and MN B circuit breaker on the Right Hand circuit breaker panel to ON (breaker pushed in), and the G/N POWER - IMU switch on the LEB Lighting Control panel to the IMU position (toggle up).
- 6.2.5.2.10 Immediately begin monitoring the following measurements.
- a. On the CRT verify that IMU Operate Power is  $+28.8 \pm 3$  VDC (CG 1500).

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6.2.5.2.10  
(Continued)

b. On the meter modules verify that oscillations are not sustained and that a null is achieved within 10 seconds of power application on the following measurements:

|         |                           |
|---------|---------------------------|
| CG 2112 | IG 1X Resolver Output Sin |
| CG 2142 | MG 1X Resolver Output Sin |
| CG 2172 | OG 1X Resolver Output Sin |

c. On the CRT verify the absence of the +120 VDC PIPA Supply (CG 1040) for a period of 90±10 seconds following power application. After approximately 100 seconds, the voltage shall read +120±6 VDC.

6.2.5.2.11 Verify that the PROGRAM ALARM lamp on the DSKY's does not light.

6.2.5.2.12 Enter and verify VERB 40, NOUN 20 into K148. Press the ENTER pushbutton.

6.2.5.2.13 Enter and verify VERB 41, NOUN 20 into K148. Press the ENTER pushbutton to advance the System to the Coarse Align mode. The VERB-NOUN display on the CRT shall flash and indicate 21-22.

6.2.5.2.14 Enter and verify +00000 into K148 three times, pressing the ENTER pushbutton on the K-148 after each entry.

6.2.5.2.15 Set the G&N OPTICS MNA and MNB circuit breakers on the Right Hand Circuit breaker panel to the ON position (breaker pushed in).

6.2.5.2.16 Verify that the CRT indications of the signals in table below are not flashing.

Secondary Power Supply Voltages

| Measurement<br>Number | Signal                     |
|-----------------------|----------------------------|
| 1 CG 1040             | +120 VDC PIPA SUPPLY       |
| 2 CG 1051             | +20 VDC PIPA SUPPLY        |
| 3 CG 1052             | -20 VDC PIPA SUPPLY        |
| 4 CG 1070             | +4 VDC CDU SUPPLY          |
| 5 CG 1100             | -28 VDC ELECTRONICS        |
| 6 CG 1020             | +14 VDC CMC SUPPLY         |
| 7 CG 1030             | VDC CMC SUPPLY             |
| 8 CG 1201             | IMU 28V 800 CPS 1 pct 0 ph |
| 9 CG 1202             | IMU 28V 800 CPS 5 pct ph A |
| 10 CG 1203            | IMU 28V 800 CPS 5 pct ph B |
| 11 CG 1331            | 3.2 KC 28V SUPPLY          |
| 12 CG 1110            | 2.5 VDC TM BIAS            |

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- 6.2.5.2.17 Monitor the PIPA Display Scope to insure that each PIPA is moding properly.
- 6.2.5.2.18 Perform 6.2.6 G&N Operational Test.
- 6.2.6 G&N Operation Test
- 6.2.6.1 Initial Conditions
- 6.2.6.1.1 Deleted.
- 6.2.6.1.2 Deleted.
- 6.2.6.1.3 Deleted.
- 6.2.6.1.4 Deleted.
- 6.2.6.2 Test Initiation
- 6.2.6.2.1 Enter VERB 92 into K148. Press the ENTER pushbutton.
- 6.2.6.2.2 Enter 00004 into K148. Press the ENTER pushbutton.
- 6.2.6.2.3 The NO ATT discrete shall appear momentarily than go OFF. Verify that the PROGRAM display on the CRT indicates 07.
- NOTE: During this portion of the test the G&N System is exercised through its modes. Any failure will be indicated by the PROGRAM ALARM lamp on the DSKY's lighting.
- 6.2.6.2.4 After approximately 12 minutes, VERB 06, NOUN 98 will flash and the value of the gravity vector in  $\text{cm/sec}^2$  shall be displayed in R1 and R2 on the CRT. Record these values.
- 6.2.6.2.5 R1 contains the first five digits of the gravity vector and R2 contains the last five digits. A decimal point shall be between them. The value for the gravity vector shall be  $980.00000 \pm 0.00000 \text{ cm/sec}^2$ .
- 6.2.6.2.6 Enter VERB 33 into K148. Press the ENTER pushbutton.
- 6.2.6.2.7 When VERB 06 NOUN 98 flashes the value of the horizontal earth rate shall be displayed in R1 and R2 on the CRT. Record these values.
- 6.2.6.2.8 R1 contains the first five digits of earth rate and R2 contains the last five digits. A decimal point shall be placed between them. R1 shall always be 00000. The horizontal earth rate shall be  $00000.88000 \pm 0.1000$  earth rate units.

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- 6.2.6.3.1 Enter VERB 36 into K148. Press the ENTER pushbutton.
- 6.2.6.3.2 Enter VERB 41, NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.6.3.3 Enter +00000 into K148 three times. Press the ENTER pushbutton after each entry.
- 6.2.7 Gimbal Friction Test
- 6.2.7.1 Deleted.
- 6.2.7.1.1 Enter the following into the K-148:
- |         |         |       |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +17000  | ENTER   |       |
| +17000  | ENTER   |       |
| +17000  | ENTER   |       |
- 6.2.7.1.2 Verify on the CRT that R1 = +17000, R2 = +17000 and R3 = +17000. Wait 15 seconds and enter the following into the K-148:
- |         |         |       |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +27000  | ENTER   |       |
| +27000  | ENTER   |       |
| +27000  | ENTER   |       |
- 6.2.7.1.3 Verify on the CRT that R1 = +27000, R2 = +27000 and R3 = +27000. Wait 15 seconds and enter the following:
- |         |         |       |
|---------|---------|-------|
| VERB 41 | NOUN 20 | ENTER |
| +00000  | ENTER   |       |
| +00000  | ENTER   |       |
| +00000  | ENTER   |       |
- 6.2.7.1.4 Verify on the CRT that R1 = +00000, R2 = +00000 and R3 = +00000. Wait 15 seconds before proceeding.
- 6.2.7.2 Inner Gimbal Friction Test
- 6.2.7.2.1 Setup the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):
- |            |                           |
|------------|---------------------------|
| a. CG 2120 | IG TORQUE MOTOR CURRENT   |
| b. CG 2117 | IGA SERVO ERROR IN PHASE  |
| c. CG 2112 | IG 1X RESOLVER OUTPUT SIN |
| d. CT 2113 | IG 1X RESOLVER OUTPUT COS |
| e. CG 2220 | IGA CDU FINE ERROR        |
| f. CG 2221 | IGA CDU Coarse Error      |

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- 6.2.7.2.2 Enter the following sequence into the K-148, pushing the ENTER pushbutton after each entry (+360 IG torquing).
- a. VERB 21 NOUN 01 ENTR
  - b. 02500 ENTR
  - c. 00000 ENTR
  - d. NOUN 15 ENTR
  - e. 00000 ENTR/ENTR
  - f. 40000 ENTR/ENTR
  - g. 40034 ENTR/ENTR
  - h. 00000 ENTR/ENTR
  - i. 00000 ENTR
- 6.2.7.2.3 Enter the following sequence into K-148:
- a. VERB 42, press ENTER
  - b. VERB 33, press ENTER
- 6.2.7.2.4 Start analog recorders.
- 6.2.7.2.5 Verify that IG Servo Error Quadrature (CG 2108) is  $0.0 \pm 1.2V$  rms. Observe measurement CG 2112, IG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes) stop the recorders.
- 6.2.7.2.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- VERB 40 NOUN 20 ENTR
  - VERB 41 NOUN 20 ENTR
  - +00000 ENTR
  - +00000 ENTR
  - +00000 ENTR
  - VERB 41 NOUN 20 ENTR
  - +17000 ENTR
  - +17000 ENTR
  - +17000 ENTR
  - VERB 41 NOUN 20 ENTR
  - +27000 ENTR
  - +27000 ENTR
  - +27000 ENTR
  - VERB 41 NOUN 20 ENTR
  - +00000 ENTR
  - +00000 ENTR
  - +00000 ENTR
- 6.2.7.2.7 Verify on the CRT that  $R1 = +00000$ ,  $R2 = +00000$ , and  $R3 = +00000$ . Wait 30 seconds before proceeding.
- 6.2.7.2.8 Enter the following sequence into the K-148. Push the ENTER pushbutton after each entry (-360° IG torquing):
- a. VERB 24 NOUN 01 ENTER
  - b. 02502, ENTER
  - c. 37777, ENTER
  - d. 37743, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.

- 6.2.7.2.9 Enter the following sequence into K-148:
- VERB 42, press ENTR
  - VERB 33, press ENTR
- 6.2.7.2.10 Start analog recorders.
- 6.2.7.2.11 Observe measurement CG 2112, IG 1X Resolver Output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.
- 6.2.7.2.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- VERB 40 NOUN 20 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR  
VERB 41 NOUN 20 ENTR  
+17000 ENTR  
+17000 ENTR  
+17000 ENTR  
VERB 41 NOUN 20 ENTR  
+27000 ENTR  
+27000 ENTR  
+27000 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.2.7.2.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.3 Outer Gimbal Friction Test.
- 6.2.7.3.1 Set up the ACE Analog Recorders to record the following measurements (use speed of 10 mm/sec):
- CG 2180 OG TORQUE MOTOR CURRENT
  - CG 2177 OGA SERVO ERROR IN PHASE
  - CG 2172 OG 1X RESOLVER OUTPUT SIN
  - CG 2173 OG 1X RESOLVER OUTPUT COS
  - CG 2280 OGA CDU FINE ERROR
  - CG 2281 OGA CDU Coarse Error
- 6.2.7.3.2 Enter the following sequence into the K-148. Pushing the ENTER pushbutton after each entry (+360° OG torquing):
- VERB 24 NOUN 01 ENTR
  - 02500, ENTR
  - 40000, ENTR
  - 40034, ENTR
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.

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- 6.2.7.3.3 Enter the following sequence into K-148:
- VERB 42, press ENTR
  - VERB 33, press ENTR
- 6.2.7.3.4 Start analog recorders
- 6.2.7.3.5 Observe measurement CG 2172, OG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorders.
- 6.2.7.3.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- VERB 40 NOUN 20 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR  
VERB 41 NOUN 20 ENTR  
+17000 ENTR  
+17000 ENTR  
+17000 ENTR  
VERB 41 NOUN 20 ENTR  
+27000 ENTR  
+27000 ENTR  
+27000 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.2.7.3.7 Verify that OG Servo Error Quadrature (CG 2168) is  $0.01 \pm 1.2V$  rms, Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = +00000. Wait 30 seconds before proceeding.
- 6.2.7.3.8 Enter the following sequence into the K-148. Push the ENTER pushbutton after each entry (-360° OG torquing):
- VERB 24 NOUN 01, ENTER
  - 02500, ENTER
  - 37777, ENTER
  - 37743, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.3.9 Enter the following sequence into K-148:
- VERB 42, press ENTER
  - VERB 33, press ENTER
- 6.2.7.3.10 Start analog recorders.
- 6.2.7.3.11 Observe measurement CG 2172, OG 1X resolver output SIN, on the analog recorder. When steady-state condition occurs, with the reading near zero (approximately 12 minutes), stop the recorder.



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- 6.2.7.3.12 Return the G&N System to the coarse align mode by entering the following sequence in the K-148:
- VERB 40 NOUN 20 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR  
VERB 41 NOUN 20 ENTR  
+17000 ENTR  
+17000 ENTR  
+17000 ENTR  
VERB 41 NOUN 20 ENTR  
+27000 ENTR  
+27000 ENTR  
+27000 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
-06750 ENTR
- 6.2.7.3.13 Verify on the CRT that R1 = +00000, R2 = +00000, and R3 = -06750. Wait 30 seconds before proceeding.
- 6.2.7.4 Middle Gimbal Friction Test.
- 6.2.7.4.1 Set up the ACE Analog Recorders to record the following measurements (use speed of 10 mn/sec):
- a. CG 2150 MG TORQUE MOTOR CURRENT  
b. CG 2147 MGA SERVO ERROR IN PHASE  
c. CG 2142 MG 1X RESOLVER OUTPUT SIN  
d. CG 2143 MG 1X RESOLVER OUTPUT COS  
e. CG 2250 MGA CDU FINE ERROR  
f. CG 2251 MGA CDU Coarse Error
- 6.2.7.4.2 Enter the following sequence into the K-148. Push the ENTER pushbutton after each entry (+135° MG torquing):
- a. VERB 24, NOUN 01, ENTER  
b. 02504, ENTER  
c. 63777, ENTER  
d. 77777, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.4.3 Enter the following sequence in the K-148:
- a. VERB 42, press ENTER  
b. VERB 33, press ENTER
- 6.2.7.4.4 Start the analog recorder.
- 6.2.7.4.5 Verify that MG Servo Error Quadrature (CG 2138) is  $0.0 \pm 1.2V$  rms. Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When steady-state condition occurs (approximately 5 minutes), stop the recorders.

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- 6.2.7.4.6 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- VERB 40 NOUN 20 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR  
VERB 41 NOUN 20 ENTR  
+17000 ENTR  
+17000 ENTR  
+17000 ENTR  
VERB 41 NOUN 20 ENTR  
+27000 ENTR  
+27000 ENTR  
+27000 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+06750 ENTR
- 6.2.7.4.7 Enter the following sequence into the K-148. Push ENTER pushbutton after each entry (-135° MG torquing):
- VERB 24 NOUN 01, ENTER
  - 02504, ENTER
  - 14000, ENTER
  - 00000, ENTER
- Verify on the CRT that (c) appears in R1, (d) appears in R2, and (b) appears in R3.
- 6.2.7.4.8 Enter the following sequence in the K-148.
- VERB 42, press ENTER
  - VERB 33, press ENTER
- 6.2.7.4.9 Start analog recorders.
- 6.2.7.4.10 Observe measurement CG 2142, MG 1X Resolver output SIN, on the analog recorder. When the steady-state condition occurs (approximately 5 minutes), stop the recorders.
- 6.2.7.4.11 Return the G&N System to the coarse align mode by entering the following sequence in the K-148.
- VERB 40 NOUN 20, press ENTER
  - VERB 41 NOUN 20, press ENTER
  - +00000, press ENTER
  - +00000, press ENTER
  - +00000, press ENTER

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- 6.2.7.5 Examine the traces of the recorded measurements for all six phases of this test to detect any sharp discontinuities. Disregard transients of 0.5 second duration or less on the Gimbal Torque motor current traces, disregard transients on the CDU fine error measurement traces. The Gimbal Torque motor currents shall not exceed 0.125 ampere. The CDU Fine Error measurements shall not exceed  $\pm 70$  mv rms. The CDU Coarse Error measurement shall not exceed  $\pm 680$  mv rms.
- 6.2.8 G&N Panel Brightness and Lamp Test
- 6.2.8.1 Proceed with this test if 6.2.5.2 or 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2 before proceeding with this test.
- 6.2.8.2 Rotate the RETICLE BRIGHTNESS thumbwheel on the Control Indicator Panel and verify the capability to control the illumination of the following lamps:
- a. SCT reticles
  - b. SXT reticles
  - c. Telescope Panel Angle Counters
- 6.2.8.3 Turn on LIGHTS-INTEGRAL control on Left Hand Circuit Breaker panel and LEB Lighting Control Panel.
- 6.2.8.4 Adjust the brightness controls on the LEB Lighting Control Panel and Left Hand Circuit Breaker Panel from minimum brightness to maximum brightness. Verify the operation of the G&N Indicator Control Panel lamps.
- 6.2.8.4.1 Re-adjust brightness controls for minimum acceptable lighting. Turn off LIGHTS-INTEGRAL control on Left Hand Circuit Breaker panel and LEB Lighting Control Panel.
- 6.2.8.5 Push and hold the CONDITION LAMPS switch on the G&N Indicator Control Panel to TEST. Verify the illumination of the following lamps:
- a. STAR ACQ
  - b. MASTER ALARM lamp
- 6.2.8.6 Set the CONDITION LAMPS switch to ON. Lamps a and b in 6.2.8.5 shall extinguish.
- 6.2.9 Semi-Automatic Moding Check
- Proceed with this test if 6.2.3 has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2 before proceeding with this test.
- 6.2.9.1 Test Initiation
- 6.2.9.1.1 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify OPTX BUS, 28V 800W1% and 5% Power Supplies.

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- 6.2.9.1.2 Enter VERB 92 into K148. Press the ENTER pushbutton.
- 6.2.9.1.3 Enter 00010 into K148. Press the ENTER pushbutton.
- 6.2.9.1.4 After approximately 5 seconds observe VERB 06 NOUN 01 flashing on the CRT and Program display indicates 07.
- 6.2.9.2 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall light. After approximately 30 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 02 flashing
  - b.  $R1 = +00000 \pm 00007$
  - c.  $R2 = +00000 \pm 00007$
  - d.  $R3 = +00000 \pm 00007$
  - e. IG angle =  $000 \pm 3$  deg.
  - f. MG angle =  $000 \pm 3$  deg.
  - g. OG angle =  $000 \pm 3$  deg.
- 6.2.9.3 Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 03 flashing
  - b.  $R1 = +04500 \pm 00007$
  - c.  $R2 = +04500 \pm 00007$
  - d.  $R3 = +04500 \pm 00007$
  - e. IG angle =  $045 \pm 3$  deg.
  - f. MG angle =  $045 \pm 3$  deg.
  - g. OG angle =  $045 \pm 3$  deg.

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6.2.9.4

Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.

- a. VERB 05 NOUN 97 flashing
- b.  $R1 = 00000 \pm 00003$
- c.  $R2 = 00000 \pm 00003$
- d.  $R3 = 00000 \pm 00003$

NOTE: Negative numbers will be displayed in octal complement form, i.e.,  $-00001 = 77776$ .

6.2.9.5

Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS Caution Lamp on the Indicator Control Panel shall light.

- a. VERB 06 NOUN 05 flashing
- b.  $R1 = +07100 \pm 00007$
- c.  $R2 = +07100 \pm 00007$
- d.  $R3 = +07100 \pm 00007$
- e. IG angle =  $071 \pm 3$  deg
- f. MG angle =  $071 \pm 3$  deg
- g. OG angle =  $071 \pm 3$  deg

The GIMBAL LOCK lamps on the DSKY's shall light.

6.2.9.6

Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.

- a. VERB 06 NOUN 06 Flashing
- b.  $R1 = +09000 \pm 00007$
- c.  $R2 = +09000 \pm 00007$
- d.  $R3 = +09000 \pm 00007$
- e. IG angle =  $090 \pm 3$  deg
- f. MG angle =  $090 \pm 3$  deg
- g. OG angle =  $090 \pm 3$  deg

6.2.9.7

Enter VERB 33 and Press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT.

- a. VERB 06 NOUN 07
- b.  $R1 = +13500 \pm 00007$
- c.  $R2 = +13500 \pm 00007$

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- 6.2.9.7 (Cont) d.  $R3 = +13500 \pm 00007$   
e. IG angle =  $135 \pm 3$  deg  
f. MG angle =  $135 \pm 3$  deg  
g. OG angle =  $135 \pm 3$  deg
- 6.2.9.8 Enter VERB 33 and press ENTER. After approximately 20 seconds VERB 06 NOUN 8 shall flash. The GIMBAL LOCK lamp shall extinguish on the DSKY's. The PGNS Caution lamp on the Indicator Control Panel shall extinguish. The gimbal angles as displayed in R1, R2 and R3 shall be approximately 135 deg, 135 deg and 45 deg, respectively.
- 6.2.9.9 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.
- a. VERB 05 NOUN 97 flashing  
b.  $R1 = 00000 \pm 00003$   
c.  $R2 = 00000 \pm 00003$   
d.  $R3 = 00000 \pm 00003$
- 6.2.9.10 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS caution lamp on the Indicator Control Panel shall light.
- a. VERB 06 NOUN 10 flashing  
b.  $R1 = +22500 \pm 00007$   
c.  $R2 = +22500 \pm 00007$   
d.  $R3 = +22500 \pm 00007$   
e. IG angle =  $225 \pm 3$  deg.  
f. MG angle =  $225 \pm 3$  deg.  
g. OG angle =  $225 \pm 3$  deg.
- The GIMBAL LOCK lamp on the DSKY's shall light.
- 6.2.9.11 Enter VERB 33 and press ENTER. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS caution lamp on the Indicator Control Panel shall extinguish.
- a. VERB 06 NOUN 11 flashing  
b.  $R1 = +22500 \pm 00007$   
c.  $R2 = +22500 \pm 00007$   
d.  $R3 = +31500 \pm 00007$   
e. IG angle =  $225 \pm 3$  deg.  
f. OG angle =  $225 \pm 3$  deg.  
g. MG angle =  $315 \pm 3$  deg.
- The GIMBAL LOCK lamp on the DSKY shall extinguish.

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- 6.2.9.12 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.
- a. VERB 05 NOUN 97 flashing
  - b. R1 = 00000±00003
  - c. R2 = 00000±00003
  - d. R3 = 00000±00003
- 6.2.9.13 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 13 flashing
  - b. R1 = +31500±00007
  - c. R2 = +31500±00007
  - d. R3 = +31500±00007
  - e. IG angle = 315±3 deg.
  - f. MG angle = 315±3 deg.
  - g. OG angle = 315±3 deg.
- 6.2.9.14 Enter VERB 33 and press ENTER. The NO ATT lamp on the DSKY's shall extinguish. After approximately 5 seconds the following data shall be displayed on the CRT.
- a. VERB 05 NOUN 97 flashing
  - b. R1 = 00000±00003
  - c. R2 = 00000±00003
  - d. R3 = 00000±00003
- 6.2.9.15 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds the following data shall be displayed on the CRT. The PGNS Caution lamp on the Indicator Control Panel shall light.
- a. VERB 06 NOUN 15 flashing
  - b. R1 = +28900±00007
  - c. R2 = +28900±00007
  - d. R3 = +28900±00007
  - e. IG angle = 289±3 deg.
  - f. OG angle = 289±3 deg.
  - g. MG angle = 289±3 deg.
- The GIMBAL LOCK lamp on the DSKY's shall light.

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6.2.9.16 Enter VERB 33 and press ENTER. After approximately 20 seconds the following data will be displayed on the CRT. The PGNS Caution lamp on the Indicator Control Panel shall extinguish.

- a. VERB 06 NOUN 16 flashing
- b.  $R1 = +00000 \pm 00007$
- c.  $R2 = +00000 \pm 00007$
- d.  $R3 = +00000 \pm 00007$
- e. IG angle =  $000 \pm 3$  deg.
- f. MG angle =  $000 \pm 3$  deg.
- g. OG angle =  $000 \pm 3$  deg.

The GIMBAL LOCK lamp on the DSKY's shall extinguish.

6.2.9.17 Enter VERB 33 and press ENTER. The COMP ACTY lamp on the DSKY's shall flash for a few seconds. After approximately 15 seconds the following data shall be displayed on the CRT.

- a. VERB 06 NOUN 98 flashing
- b.  $R1 = 000xx$
- c.  $R2 = xxxxx$

The GIMBAL LOCK lamp on the DSKY's shall light. The PGNS Caution lamp on the Indicator Control Panel shall light.

Record  $R1$  and  $R2$  as the Middle Gimbal CDU drive rate. MG rate =  $\frac{R1 \cdot R2}{\text{sec}}$ . The Middle Gimbal CDU drive rate shall be  $14 \pm 2$ "/sec.

6.2.9.18 Enter VERB 33 into K148. Press the ENTER pushbutton. After approximately 30 seconds the following data shall be displayed on the CRT.

- a. VERB 06 NOUN 98 flashing
- b.  $R1 = 000xx$
- c.  $R2 = xxxxx$

The GIMBAL LOCK lamp on the DSKY's shall extinguish. The PGNS Caution lamp on the Indicator Control Panel shall extinguish.

Record  $R1$  and  $R2$  as the Inner Gimbal CDU drive rate. IG rate =  $\frac{R1 \cdot R2}{\text{sec}}$ . The Inner Gimbal CDU drive rate shall be  $14 \pm 2$ "/sec.



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- 6.2.9.19 Enter VERB 33 into K148. Press the ENTER pushbutton. After approximately 30 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98 flashing
  - b. R1 = 000xx
  - c. R2 = xxxx
- Record R1 and R2 as the Outer Gimbal CDU drive rate.  
OG rate =  $\frac{R1}{R2} \cdot \frac{R2}{sec}$ . The Outer Gimbal CDU drive rate shall be  $14 \pm 2$ "/sec.
- 6.2.9.20 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall extinguish. After approximately 20 seconds VERB 21 NOUN 22 shall flash on the CRT. Enter +00100 into K148 three times. Press the ENTER pushbutton after each entry. The NO ATT lamp on the DSKY's shall momentarily light, then extinguish. After approximately 100 seconds VERB 01 NOUN 10 flashing shall be displayed on the CRT. Press the ENTER pushbutton.
- Verify R1 = 33xxx.
- The ISS WARNING Lamp on the Indicator Control Panel shall light.  
The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be ON.
- 6.2.9.21 Enter VERB 33 into K148. Press the ENTER pushbutton. ISS WARNING and ISS CDU FAIL shall be OFF. After approximately 20 seconds VERB 21 NOUN 22 shall flash on the CRT. Enter +03375 into K148 three times. Press the ENTER pushbutton after each entry. The NO ATT lamp on the DSKY's shall momentarily light, then extinguish. After approximately 100 seconds VERB 01 NOUN 10 flashing shall be displayed on the CRT. Press the ENTER pushbutton.
- Verify R1 = 33xxx.
- The ISS WARNING lamp on the Indicator Control Panel shall light.  
The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be ON.
- 6.2.9.22 Enter VERB 33 into K148. Press the ENTER pushbutton. The NO ATT lamp on the DSKY's shall light. After approximately 20 seconds VERB 06 NOUN 91 shall flash on the CRT. The ISS WARNING lamp on the Control Indicator Panel shall extinguish. The ISS WARNING and ISS CDU FAIL discretes on the CRT shall be OFF.
- 6.2.9.23 CAUTION; See paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Set the OPTICS MODE switch to CMC.
- 6.2.9.24 Enter VERB 33, press ENTER. After approximately 25 seconds the following data shall be displayed on the CRT.

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- 6.2.9.24 (Cont) a. VERB 06 NOUN 98 flashing  
b. R1 = 000xx  
c. R2 = xxxxx
- Record R1 and R2 as the Shaft Optics CDU drive rate.  
Shaft rate =  $R1 \cdot R2$ . The Shaft Optics CDU drive rate shall be  $15.10 \pm 3.78^\circ/\text{sec}$ .
- 6.2.9.25 Enter VERB 33 into K148. Press the ENTR pushbutton. In about 15 seconds the following data shall be displayed on the CRT.
- a. VERB 06 NOUN 98  
b. R1 = 0000x  
c. R2 = xxxxx
- Record R1 and R2 as the Trunnion Optics CDU drive rate. Trunnion rate =  $R1 \cdot R2$ . The Trunnion Optics CDU drive rate shall be  $3.77 \pm 0.94^\circ/\text{sec}$ .
- 6.2.9.26 Terminate the Semi-Automatic Moding Check by entering VERB 34 into K148. Observe PROG display on DSKY's is 00. Press the ENTER pushbutton.
- 6.2.9.27 Computer Manual Mode Optics Drive
- NOTE: Perform the following procedure only if GNIC panel, P/N 2021290-51 is installed in the spacecraft.
- 6.2.9.27.1 Place the OPTICS ZERO switch on the Indicator Control Panel to ZERO and the OPTICS MODE switch to CMC.
- 6.2.9.27.1.1 Wait 20 seconds and then place the OPTICS ZERO switch on the Indicator Control Panel to OFF.
- 6.2.9.27.1.2 Perform the following on the DSKY:
- VERB 41 NOUN 91 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.2.9.27.2 Place the OPTICS MODE switch on the Indicator Control Panel to MANUAL. Perform the following step within 1 minute.
- 6.2.9.27.2.1 Perform the following on the DSKY:
- VERB 21 NOUN 10 ENTR  
00012 ENTR  
00002 ENTR

6.2.9.27.2.2 Perform the following on the DSKY:  
VERB 16 NOUN 91 ENTR  
Record R1 and R2 when the values settle out.

6.2.9.27.2.3 Set the OPTICS ZERO switch to ZERO.

6.2.9.27.2.4 Perform the following on the DSKY after a 10-second delay:  
VERB 24 NOUN 01 ENTR  
00053 ENTR  
00360 ENTR  
00360 ENTR  
VERB 21 NOUN 10 ENTR  
00012 ENTR  
00002 ENTR/ENTR  
00014 ENTR  
06000 ENTR

6.2.9.27.2.5 Set the OPTICS ZERO switch on the Indicator Control Panel to OFF.

6.2.9.27.2.6 Press the Key Release pushbutton. Record R1 and R2 when they are settled out.

6.2.9.27.2.7 Perform the following calculations for Shaft and Trunnion. Subtract the values of R1 and R2 from Step 6.2.9.27.2.2 from the respective values of R1 and R2 of Step 6.2.9.27.2.6.  
Verify  $R1_6 - R1_2 = 10.65 \text{ deg} \pm 1.00 \text{ deg}$   
and  $R2_6 - R2_2 = 2.66 \text{ deg} \pm 0.26 \text{ deg}$

6.2.9.27.3 Set the SPEED switch to "MED" and the DIRECT/RESOLVED switch to DIRECT.

6.2.9.27.4 Set the OPTICS Hand Controller full right. Record R1 and release the Hand Controller.

6.2.9.27.4.1 Set the OPTICS Hand Controller full left. Record R1 and release the Hand Controller.

6.2.9.27.4.2 Perform the following calculations for Shaft. Subtract the value of R1 from Step 6.2.9.27.2.6 ( $R1_{26}$ ) from the value of R1 recorded in Step 6.2.9.27.4 ( $R1_{40}$ ).  
Verify  $R1_{40} - R1_{26} = +1.63 \text{ deg} \pm 0.49 \text{ deg}$ .  
Subtract the value of R1 from Step 6.2.9.27.2.6 ( $R1_{26}$ ) from the value of R1 recorded in Step 6.2.9.27.4.1 ( $R1_{41}$ ).  
Verify  $R1_{41} - R1_{26} = -1.63 \text{ deg} \pm 0.49 \text{ deg}$ .

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- 6.2.9.27.4.3 Set the OPTICS Hand Controller full up. Record R2 and release the Hand Controller.
- 6.2.9.27.4.4 Set the OPTICS Hand Controller full down. Record R2 and release the Hand Controller.
- 6.2.9.27.4.5 Perform the following calculations for Trunnion. Subtract the value of R2 from Step 6.2.9.27.2.6 (R2<sub>26</sub>) from the value of R2 recorded in Step 6.2.9.27.4.3 (R2<sub>43</sub>).
- Verify  $R2_{43} - R2_{26} = 0.40 \text{ deg} \pm 0.12 \text{ deg}$ .
- Subtract the value of R2 from Step 6.2.9.27.2.6 (R2<sub>26</sub>) from the value of R2 recorded in Step 6.2.9.27.4.4 (R2<sub>44</sub>).
- Verify  $R2_{44} - R2_{26} = -0.40 \text{ deg} \pm 0.12 \text{ deg}$ .
- 6.2.9.27.5 Perform the following on the DSKY:
- VERB 21 NOUN 10 ENTR  
00012 ENTR  
00000 ENTR
- 6.2.9.28 OPTICS CDU FINE ERROR TESTS
- 6.2.9.28.1 Set the OPTICS MODE switch to MAN.
- 6.2.9.28.2 Perform the following on the DSKY:
- VERB 21 NOUN 10 ENTR  
00012 ENTR  
00000 ENTR
- 6.2.9.28.3 Using the OPTICS HAND CONTROLLER and a convenient CONTROLLER SPEED, drive the optics shaft until the shaft TPAC indicates 150 degrees and drive the optics trunnion until the trunnion TPAC indicates 0.00 degrees. Place OPTICS SPEED switch in LO.
- 6.2.9.28.4 Perform the following on the DSKY:
- VERB 21 NOUN 10 ENTR  
00012 ENTR  
00001 ENTR
- Observe: Tracker Fail and PGNS Warning lamps ON.

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6.2.9.28.5 Perform the following on the DSKY:

|         |      |      |
|---------|------|------|
| VERB 21 | NOUN | ENTR |
| 00012   |      | ENTR |
| 00000   |      | ENTR |

Depress Error Reset and observe the Tracker Fail and PGNS Warning lamps OFF.

6.2.9.28.6 Using the OPTICS HAND CONTROLLER and a convenient CONTROLLER SPEED, drive the optics shaft until the shaft TPAC indicates 0.00 degree and drive the optics trunnion until the TPAC indicates 0.75 degree. Place OPTICS SPEED switch to LO.

6.2.9.28.7 Perform the following on the DSKY:

|         |         |      |
|---------|---------|------|
| VERB 21 | NOUN 10 | ENTR |
| 00012   |         | ENTR |
| 00001   |         | ENTR |

Observe: Tracker Fail and PGNS Warning lamps ON.

6.2.9.28.8 Perform the following on the DSKY:

|         |         |      |
|---------|---------|------|
| VERB 21 | NOUN 10 | ENTR |
| 00012   |         | ENTR |
| 00000   |         | ENTR |

Depress Error Reset and observe the Tracker Fail and PGNS Warning lamps OFF.

6.2.9.28.9 Set the ZERO OPTICS switch to ZERO.

6.2.9.29 Set the G/N Power-Optics Switch on the LEB lighting control panel to OFF.

6.2.10 Zero Optics Test

6.2.10.1 Set the G&N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.

NOTE: Proceed with this test if 6.2.3 Operate Power on test has been completed and system operation has not been interrupted. If system operation has been interrupted perform 6.2.5.2. Turn On Procedure before proceeding.

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INITIALIZATION

6.2.10.2 Insure that the following switches on the G&N Indicator Control Panel are set as follows:

- a. OPTICS TEL TRUN to SLAVE to SXT
- b. OPTICS COUPLING to DIRECT
- c. OPTICS SPEED to HI
- d. OPTICS MODE to MAN

OPTICS ZERO MODE TEST

6.2.10.3 Monitor the Optics CDU's by entering VERB 16 NOUN 91 into KI48. Press the ENTER pushbutton.

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- 6.2.10.4 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Verify the Optics zeroed properly by observing the following on R1 and R2 of the CRT.
- a.  $R1 = +0.00^\circ + 0.02^\circ, -0.03^\circ$  (Shaft Angle)  
b.  $R2 = +0.000^\circ + 0.006^\circ, -0.007^\circ$  (Trunnion Los Angle)
- 6.2.10.4.1 Enter the following:
- VERB 01 NOUN 10, ENTER  
00033 ENTER
- Verify R1 = XXX6X
- 6.2.10.4.2 Set the OPTICS ZERO switch to OFF and the OPTICS MODE switch to CMC. Enter the following:
- ENTER  
00033, ENTER
- Verify R1 = XXX5X
- 6.2.10.4.3 Set the OPTICS MODE switch to MAN. Press the KEY-REL pushbutton.
- OPTICS TIME TO ZERO TEST
- 6.2.10.5 Deleted.
- 6.2.10.6 Deleted.
- 6.2.10.7 Deleted.
- 6.2.10.8 Deleted.
- 6.2.10.9 Deleted.
- 6.2.10.10 Deleted.
- 6.2.10.11 Deleted.
- OPTICS BACKUP MODE TEST

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- 6.2.10.12 Insert the Inflight Tool (V36601405) into the Trunnion Tool input and engage drive mechanism (button out). Verify that the trunnion turns by viewing the movement through the SCT eyepiece while turning the tool until the TPAC reads +5°. Remove the tool from the Trunnion tool input.
- 6.2.10.13 Insert the Inflight Tool (V36601405) into the Shaft Tool input and engage the drive mechanism (button out). Verify that the Shaft turns by viewing the movement through the SCT eyepiece while turning the tool so that the shaft moves through an angle from 0° to +3° to 0° as indicated on the shaft TPAC. Disengage the shaft drive mechanism (button in) and remove the tool.
- 6.2.10.14 Insert the Inflight Tool (V36601405) into the Trunnion Tool input. Verify that the Trunnion turns by viewing the movement through the SCT eyepiece while turning the tool so that the trunnion moves from +5° to -5° and back to zero as indicated on the Trunnion TPAC. Disengage the trunnion drive mechanism (button in) and remove the tool.
- 6.2.11 OPTICS Coordinate Transformation Control Test.
- 6.2.11.1 Set the G/N POWER-OPTICS switch on the LEB to OPTICS. Verify Power Supplies.
- NOTE: Proceed with this test if 6.2.3 Operate Power On Test has been completed and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2, Turn On Procedure, before proceeding.
- INITIALIZATION
- 6.2.11.2 Verify and/or set the following switches on the G&N Indicator Control Panel to the position indicated.
- a. OPTICS TEL TRUN to SLAVE to SXT
  - b. OPTICS COUPLING to DIRECT
  - c. OPTICS SPEED to HI
  - d. OPTICS MODE to MAN
- 6.2.11.3 Enter the following into the K-148.
- VERB 16 NOUN 91 ENTR
- 6.2.11.3.1 Deleted.
- 6.2.11.3.1.1 Deleted.
- 6.2.11.3.1.2 Deleted.



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- 6.2.11.4 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS ZERO switch on the G&N Panel to ZERO. Wait 15 seconds. Return the OPTICS ZERO switch to OFF.
- 6.2.11.5 Set up the analog recorders to monitor the following measurements:
- a. CG 3170 SCT Trunnion Tachometer Output.
- RESOLVED MODE PHASING AND IMAGE RATE TEST.
- 6.2.11.6 Using the OPTICS CONTROL STICK, drive the Optics until  $R1 = +225.00$  and  $R2 = +10.000$  on the CRT and the DSKY's.
- 6.2.11.7 Set the OPTICS COUPLING switch on the G&N Panel to RSLV and the OPTICS Speed switch to MED.
- 6.2.11.8 Position the movable optics target such that it is centered on the SCT reticle pattern.
- 6.2.11.9 Record time. Quickly displace the OPTICS CONTROL STICK  $45 \pm 10$  degrees in the upper right hand quadrant while sighting on the optics target through the SCT eyepiece. The target shall appear to move in the upper right field of view of the SCT at  $45 \pm 10$  deg. When target leaves the SCT upper right field of view press MARK pushbutton. The PROG alarm light shall light.
- 6.2.11.10 From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the Shaft CDU register (address 36) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) and the PROG alarm discrete for the period during which the OPTICS CONTROL STICK was being displaced above. The Shaft CDU angle shall be  $225.00 \pm 10.00$  degrees at the time the PROG alarm occurred. The elapsed time from time of OPTICS CONTROL STICK displacement to the time the PROG alarm discrete is obtained shall be 19 to 32 seconds.
- 6.2.11.11 Set the OPTICS COUPLING switch to DIRECT. Again using the OPTICS CONTROL STICK, drive the optics until  $R1 = +225.00$  and  $R2 = +10.000$ . Set the OPTICS COUPLING switch to RSLV.
- 6.2.11.12 While sighting on the optical target through the SCT eyepiece, displace the OPTICS CONTROL STICK fully to the right. Verify that the target image appears to move in a straight line horizontally to the right and release the OPTICS CONTROL STICK when the target image reaches the edge of the SCT field of view.

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- 6.2.11.13 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS COUPLING switch on the G&N Panel to DIRECT.  
Set the OPTICS ZERO switch to ZERO.
- 6.2.12 OPTICS FUNCTIONAL TEST
- 6.2.12.1 Deleted.
- 6.2.12.2 Set/verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify the following:
  - a. +28 VDC OPTX OPERATE BUS (CG 1530) is  $28.8 \pm 3$  VDC. Record the indication on the CRT.
  - b. CG 1211 OPTX 28V 800 cps 1% 0 ph not flashing on CRT.
  - c. CG 1212 OPTX 800 cps 5% -90 ph not flashing on CRT.
- 6.2.12.3 Deleted
- 6.2.12.4 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Insure that the Optics control switches on the G&N Indicator Control Panel are set as follows:
  - a. OPTICS ZERO to ZERO
  - b. OPTICS MODE to MAN
  - c. OPTICS SPEED to LO
  - d. OPTICS COUPLING to DIRECT
  - e. OPTICS TRUN to SLAVE to SXT
- 6.2.12.5 Set OPTICS ZERO switch to OFF.
- 6.2.12.6 Resolution checks
- 6.2.12.6.1 SXT Resolution Check - MSO only
- 6.2.12.6.1.1 Sight through the SXT eyepiece. Using the OPTICS CONTROL STICK, adjust the SXT to obtain the best reflected field of view of the 5-inch autocollimator reticle engravings at the center of view.
- 6.2.12.6.1.2 Note that the autocollimator reticle contains a series of lines of different thickness and width. Each set of lines is marked with a number (20, 15, 10, 7, 5, 3) which indicates the angle subtended by one line and one space. View each set of lines to determine the lowest numbered set in which resolution between lines (ability to distinguish separate distinct lines within a set) can be made. Record the number associated with that set of lines. The SXT resolution shall be at least 10 arc seconds at the center of the field of view.

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- 6.2.12.6.2 SCT Resolution Check
- 6.2.12.6.2.1 Sight through the SCT EYEPIECE. Using the OPTICS CONTROL STICK adjust the SCT to obtain the best view of the SCT RESOLUTION CHART held in the Optics line of sight.
- 6.2.12.6.2.2 Note the chart contains sets of lines. View each set of lines to determine the lowest numbered set in which the resolution between lines (ability to distinguish separate lines within a set) can be made. The SCT shall have a resolution of at least 3 arc minutes at the center of the field of view.
- 6.2.12.7 Slave Telescope Mode Checks
- 6.2.12.7.1 Verify/perform OPTICS POWER ON TEST per paragraph 6.2.3.2.
- 6.2.12.7.2 Set/Verify the following switches on G&N INDICATOR CONTROL PANEL:
- a. OPTICS TEL TRUN - SLAVE to SXT
  - b. OPTICS COUPLING - DIRECT
  - c. OPTICS SPEED - HI
- 6.2.12.7.3 Monitor OCDU's by entering VERB 16 NOUN 91 into K-148. Press ENTER.
- 6.2.12.7.4 Set OPTICS MODE to MAN.
- 6.2.12.7.5 Using the Optics Hand Controller drive the optics until:
- R1 = +000.00±001.00 (SHAFT)  
R2 = +10.000±01.000 (TRUNNION)
- 6.2.12.7.6 Verify on the CRT and Optics Panel:
- SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = R2 ±0.22 DEG
- 6.2.12.7.7 Set the OPTICS TEL TRUN on the G&N INDICATOR CONTROL PANEL to 0°.
- 6.2.12.7.8 Verify:
- SHAFT TPAC = R1 ±0.11 DEG  
TRUN TPAC = 0.0° ±0.22 DEG
- R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.9 Set the OPTICS TEL TRUN on the G&N INDICATOR CONTROL PANEL TO OFFSET 25°.

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- 6.2.12.7.10 Verify on CRT and Optics Panel:
- SHAFT TPAC =  $R1 \pm 0.11$  DEG  
TRUN TPAC =  $25' \pm 1.00$  DEG  
R2 approximately equal to value specified in step 6.2.12.7.5.
- 6.2.12.7.11 On the G&N INDICATOR CONTROL PANEL set the OPTICS TEL TRUN to SLAVE to SXT.
- 6.2.12.7.12 Verify on CRT and Optics Panel:
- SHAFT TPAC =  $R1 \pm 0.11$  DEG  
TRUN TPAC =  $R2 \pm 0.22$  DEG
- 6.2.12.7.13 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
On the G&N INDICATOR CONTROL PANEL set the OPTICS ZERO to ZERO.  
Wait 15 sec.
- 6.2.12.7.14 Verify on CRT and OPTICS PANEL.
- $R1 = 000.00 +000.02, -000.03$   
 $R2 = 00.000 +00.006, -00.007$
- SHAFT TPAC =  $R1 \pm 0.11$  DEG  
TRUN TPAC =  $R2 \pm 0.22$  DEG
- 6.2.12.7.15 If Optics testing will not be continued, set the G&N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.
- 6.2.12.8 SXT Parallelism Tests
- 6.2.12.8.1 Remove the plug from the base of the SXT eyepiece and install the Adapter Assembly and Portable Light Assembly. Turn on the light.
- NOTE: If needed to reduce external light, place a photographers hood over the optics head.
- 6.2.12.8.2 SXT Auto Collimator Parallelism Test - MSO only.
- 6.2.12.8.2.1 Using the OPTICS CONTROL STICK drive the SXT St LOS Trunnion to  $+15.00' \pm 2'$  as indicated in R2 of the DSKY. Maintain a Shaft CDU angle of  $000.00 \pm 0.10$  degrees.
- 6.2.12.8.2.2 Sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to superimpose the SXT LLOS horizontal reticle image upon the autocollimator horizontal filar. Record the autocollimator reading.

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- 6.2.12.8.2.3 Repeat 6.2.12.8.2.2 twice. Calculate and record the average of the three autocollimator readings.
- 6.2.12.8.2.4 Set the OPTICS ZERO switch to ZERO.
- 6.2.12.8.2.5 Again sight through the 5-inch autocollimator eyepiece and adjust the measurement knob to bring the SXT St LOS horizontal reticle and autocollimator horizontal filar images to coincide. Record the autocollimator reading.
- 6.2.12.8.2.6 Repeat 6.2.12.8.2.5 twice. Calculate and record the average of the three autocollimator readings. The average value obtained here shall not differ from that obtained in 6.2.12.2.3 by more than 10 arc seconds.
- 6.2.12.8.3 Deleted.
- 6.2.12.8.3.1 Deleted.
- 6.2.12.8.3.2 Deleted.
- 6.2.12.8.3.3 Deleted.
- 6.2.12.8.3.4 Deleted.
- 6.2.12.9 SXT, CMC Functional Check
- 6.2.12.9.1 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS MODE switch to MAN. Set the OPTICS ZERO switch to ZERO. After 15 seconds, return the switch to OFF.
- 6.2.12.9.2 Sight through the SXT. Using the Control Stick align the SXT St LOS with Optical Target No. 1.
- 6.2.12.9.3 When aligned, record the value of the Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.4 Sight through the SXT. Using the Control Stick align the SXT St LOS with Optical Target No. 2.
- 6.2.12.9.5 When aligned, record the value of the Shaft and Trunnion CDU's from the CRT.
- 6.2.12.9.6 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. After 15 seconds set the OPTICS ZERO switch to OFF. Set the OPTICS MODE switch to CMC.

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- 6.2.12.9.7 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for Shaft from 6.2.12.9.3 into the DSKY and press ENTER. Enter the value for Trunnion from 6.2.12.9.3 into the DSKY and press ENTER.
- 6.2.12.9.8 Sight through the SXT. The St LOS should be approximately centered on the Optical Target No. 1 Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.3 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.9 Enter VERB 41, NOUN 91, ENTER into the DSKY. Enter the value for shaft from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton. Enter the value for Trunnion from 6.2.12.9.5 into the DSKY and press the ENTER pushbutton.
- 6.2.12.9.10 Sight through the SXT. The St LOS should be approximately centered on the Optical Target No. 2. Record the value of Shaft and Trunnion CDU's from the CRT. The difference between these values and the corresponding values recorded in 6.2.12.9.5 shall be less than 0.06 degrees for the Shaft and 0.02 degrees for the Trunnion. Record the difference.
- 6.2.12.9.11 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds.
- 6.2.12.9.12 If OPTICS testing will not continue, set the G&N Power Optics switch on the LEB Lighting Panel to OFF.
- 6.2.13 Optics Slew Rate Tests
- 6.2.13.1 Optics Hand Controller Rates
- 6.2.13.1.1 Verify the appropriate K-Start tape for OPT H/C SLEW RATE & RATE SF is on the K-Start reader. The tape numbers and their associated Flight Ropes are found in Appendix II. Start the tape reader. When tape reader stops, verify the following on the CRT DSKY display:
- (a) R1 = +08282
  - (b) R2 = +10598
  - (c) R3 = -000ZX (X is tape revision number, Z is the revision to the rope revision number.)
- 6.2.13.1.2 Start the tape reader. When tape reader stops, verify R1 = 00100.

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- 6.2.13.1.3 Set/Verify the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify that +28 VDC OPTICS OPERATE BUS (CG1530) is +28.0±3.0 VDC. Verify that OPTX 28V 800 cps 1% zero (CG 1211) and OPTX 28V 800 cps 5%-90 ph (CG 1212) are not flashing on the CRT.
- 6.2.13.1.4 Verify and/or set the following switches on the G&N Indicator Control Panel to the positions indicated.
- (a) TEL TRUN to SLAVE to SXT
  - (b) OPTICS COUPLING to DIRECT
  - (c) OPTICS SPEED to HI
  - (d) OPTICS MODE to MAN
  - (e) OPTICS ZERO to OFF
- POSITIVE SHAFT SLEW RATE - HI SPEED
- 6.2.13.1.5 Using the OPTICS CONTROL STICK and a convenient CONTROLLER SPEED switch setting, carefully slew the SXT Trunnion to within +5 degrees of zero as indicated by the TPAC (Telescope Trunnion slaved to SXT). Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Wait 15 seconds. Return OPTICS SPEED to HI.
- NOTE: Read and understand the next three steps before proceeding.
- 6.2.13.1.6 While slewing the optics, record the following signals: SXT SHAFT SERVO error (CG 3117), SXT SHAFT TACH (CG 3140), and SCT SHAFT TACH (CG 3160). CG 3117 shall be less than -0.25 VRMS. CG 3140 shall be  $3.3 \pm 1.3$  VRMS. CG 3160 shall be  $-3.3 \pm 1.3$  VRMS.
- 6.2.13.1.7 Start tape reader. When the tape reader stops, verify R1 = 00101.
- 6.2.13.1.8 Set the OPTICS ZERO switch on the G&N Indicator Control Panel to OFF. Immediately push and hold the OPTICS CONTROL STICK to its right limit until the shaft on TPAC reading indicates 175 degrees. Release the Control Stick. VERB 06 NOUN 98 shall be displayed flashing on DSKY. Record the R1 and R2 display (R1 is whole part and R2 is fractional part (deg/sec)). Value recorded shall be  $19.5 \pm 3.9$  deg/sec.
- POSITIVE TRUNNION SLEW RATE - HI SPEED
- NOTE: Read and understand the next two steps before proceeding.
- 6.2.13.1.9 While slewing the optics after the tape load, record the following signals: SXT TRUN SERVO error (CG 3118), SXT TRUN TACH (CG 3150) and SCT TRUN TACH (CG 3170). CG 3118 shall be less than -0.25 VRMS. CG 3150 shall be  $3.3 \pm 1.3$  VRMS. CG 3170 shall be  $-0.85 \pm 0.35$  VRMS.

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6.2.13.1.10 Using the OPTICS CONTROL STICK and a convenient CONTROLLER SPEED drive the Optics Trunnion to  $0 \pm 1$  degree as indicated on the TPAC. Return OPTICS SPEED to HI. Immediately start the tape reader. When tape reader stops, verify R1 = 00102. Within 10 seconds push and hold the OPTICS CONTROL STICK to its upper limit until the Trunnion TPAC reading indicates 50 deg. Release the OPTICS CONTROL STICK. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record R1 and R2 display (R1 as whole part and R2 as fractional part (deg/sec)). Value recorded shall be  $10 \pm 2$  deg/sec.

NEGATIVE SHAFT SLEW RATE - HI SPEED

NOTE: Read and understand the next step before proceeding.

6.2.13.1.11 Using the OPTICS CONTROL STICK and a convenient CONTROLLER SPEED drive the optics shaft to  $175 \pm 1$  deg as indicated on the TPAC. Return OPTICS SPEED to HI. Immediately start the tape reader. When tape reader stops, verify R1 = 00103. Within 10 seconds push and hold the OPTICS CONTROL STICK to its left limit until the shaft TPAC reading indicates 0 degrees. Release the OPTICS CONTROL STICK. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record R1 and R2 display (R1 as whole part and R2 is fractional part (deg/sec)). Value recorded shall be  $-19.5 \pm 3.9$  deg/sec.

NEGATIVE TRUNNION SLEW RATE - HI SPEED

NOTE: Read and understand the next step before proceeding.

6.2.13.1.12 Using the OPTICS CONTROL STICK and a convenient CONTROLLER SPEED drive the optics trunnion to  $50 \pm 1$  deg as indicated on the TPAC. Return OPTICS SPEED switch to HI. Immediately start the tape reader. When tape reader stops, verify R1 = 00104. Within 10 seconds, push and hold the OPTICS CONTROL STICK to its lower limit until the trunnion TPAC reading indicates 5 degrees. Release the OPTICS CONTROL STICK. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record R1 and R2 display (R1 as whole part and R2 as fractional part (deg/sec)). Value recorded shall be  $-10.0 \pm 2.0$  deg/sec.

6.2.13.1.12.1 Start tape reader. When tape reader stops, verify R1 = 00105.

POSITIVE SHAFT SLEW RATE - MED SPEED

6.2.13.1.13 Using the OPTICS CONTROL STICK and a convenient CONTROLLER SPEED switch setting, carefully slew the SXT Trunnion to within +5 degrees of zero as indicated by the TPAC (Telescope Trunnion slaved to SXT). Set the



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- 6.2.13.1.13 -continued-  
OPTICS ZERO switch to ZERO. Wait 15 seconds. Set OPTICS SPEED to MED.
- NOTE: Read and understand the next three steps before proceeding.
- 6.2.13.1.14 Record the SXT SHAFT MTR control winding (CG 3145) signal on the CRT while slewing the optics. CG 3145 shall be  $\pm 0.50$  to  $\pm 4.0$  VRMS.
- 6.2.13.1.15 Start tape reader. When the tape reader stops, verify R1 = 00106.
- 6.2.13.1.16 Set the OPTICS ZERO switch on the G&N Indicator Control Panel to OFF. Immediately push and hold the OPTICS CONTROL STICK to its right limit until the shaft TPAC reading indicates 135 degrees. Release the control stick. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record the R1 and R2 display (R1 is whole part and R2 is fractional part (deg/sec)). Value recorded shall be  $2.0 \pm 0.4$  deg/sec.
- POSITIVE TRUNNION SLEW RATE - MED SPEED
- NOTE: Read and understand the next two steps before proceeding.
- 6.2.13.1.17 Record the SXT TRUN MTR control winding (CG 3155) signal on the CRT while slewing the optics after the tape load. CG 3155 shall be  $\pm 0.25$  to  $\pm 2.00$  VRMS.
- 6.2.13.1.18 Using the OPTICS CONTROL STICK and a convenient CONTROLLER SPEED drive the Optics Trunnion to  $0 \pm 1$  degree as indicated on the TPAC. Return OPTICS SPEED to MED. Immediately start the tape reader. When the tape reader stops, verify R1 = 00107. Within 10 seconds push and hold the OPTICS CONTROL STICK to its upper limit until the trunnion TPAC reading indicates 47 degrees. Release the OPTICS CONTROL STICK. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record R1 and R2 display (R1 is whole part and R2 is fractional part (deg/sec)). Value recorded shall be  $-2.0 \pm 0.4$  deg/sec.
- NEGATIVE SHAFT SLEW RATE - MED SPEED
- NOTE: The next step must be performed within 5 minutes of the completion of the Medium Speed Positive Shaft Slew Rate Test.
- 6.2.13.1.19 Start the tape reader. When the tape reader stops, verify R1 = 00110. Push and hold the OPTICS CONTROL STICK to its left limit until the shaft

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6.2.13.1.19

-continued-

TPAC reading indicates 0 degrees. Release the OPTICS CONTROL STICK. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record R1 and R2 display (R1 is whole part and R2 is fractional part (deg/sec)). Value recorded shall be  $-2.0 \pm 0.4$  deg/sec.

NEGATIVE TRUNNION SLEW RATE - MED SPEED

NOTE: The next step must be performed within 5 minutes of the completion of the Medium Speed Positive Trunnion Slew Rate Test.

6.2.13.1.20

Start the tape reader. When the tape reader stops, verify R1 = 00111. Push and hold the OPTICS CONTROL STICK to its lower limit until the trunnion TPAC reading indicates 0 deg. Release the OPTICS CONTROL STICK. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record R1 and R2 display (R1 is whole part and R2 is fractional part (deg/sec)). Value recorded shall be  $-1.0 \pm 0.2$  deg/sec.

6.2.13.1.20.1

Start tape reader. When tape reader stops, verify R1 = 00112.

POSITIVE SHAFT SLEW RATE - LO SPEED

6.2.13.1.21

Using the OPTICS CONTROL STICK and a convenient CONTROLLER SPEED switch setting, carefully slew the SXT Trunnion to within +5 degrees of zero as indicated by the TPAC (Telescope Trunnion slaved to SXT). Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set OPTICS SPEED to LO.

6.2.13.1.22

Start tape reader. When the tape reader stops, verify R1 = 00113. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to OFF. Immediately push and hold the OPTICS CONTROL STICK to its right limit until the shaft TPAC reading indicates 17 degrees. Release the control stick. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record the R1 and R2 display (R1 is whole part and R2 is fractional part (deg/sec)). Value recorded shall be  $0.20 \pm 0.04$  deg/sec.

POSITIVE TRUNNION SLEW RATE - LO SPEED

NOTE: Read and understand the next step before proceeding.

6.2.13.1.23

Using the OPTICS CONTROL STICK and a convenient CONTROLLER SPEED drive the Optics Trunnion to  $0 \pm 1$  deg as indicated on the TPAC. Return OPTICS SPEED to LO. Immediately start the tape reader. When

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6.2.13.1.23

-continued-

tape reader stops, verify R1 = 00114. Within 10 seconds push and hold the OPTICS CONTROL STICK to its upper limit until the trunnion TPAC reading indicates 7 deg. Release the OPTICS CONTROL STICK. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record R1 and R2 display (R1 is whole part and R2 is fractional part (deg/sec)). Value recorded shall be  $+0.1 \pm 0.02$  deg/sec.

NEGATIVE SHAFT SLEW RATE - LO SPEED

NOTE: The following step must be performed within 5 minutes of completing the Low Speed Positive Shaft Slew Rate Test.

6.2.13.1.24

Start the tape reader. When tape reader stops verify R1 = 00115. Push and hold the OPTICS CONTROL STICK to its left limit until the shaft TPAC reading indicates 0 degree. Release the OPTICS CONTROL STICK. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record R1 and R2 display (R1 is whole part and R2 is fractional part (deg/sec)). Value recorded shall be  $-0.2 \pm 0.04$  deg/sec.

NEGATIVE TRUNNION SLEW RATE - LO SPEED

NOTE: The following step must be performed within 5 minutes of completing the Low Speed Trunnion Slew Rate Test.

6.2.13.1.25

Start the tape reader. When tape reader stops, verify R1 = 00116. Push and hold the OPTICS CONTROL STICK to its lower limit until the shaft TPAC reading indicates 0 deg. Release the OPTICS CONTROL STICK. VERB 06 NOUN 98 shall be displayed flashing on the DSKY. Record R1 and R2 display (R1 is whole part and R2 is fractional part (deg/sec)). Value recorded shall be  $-0.1 \pm 0.2$  deg/sec.

TEST TERMINATION

6.2.13.1.26

Start tape reader. When tape reader stops, verify R1 = 00117.

OPTICS HAND CONTROLLER DRIFT RATE CHECK - LO SPEED

6.2.13.2

CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to ZERO. Wait 15 seconds. Set the OPTICS ZERO switch to OFF. Record time. Wait 60 seconds.

6.2.13.3

Perform the following calculations:

From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the Trunnion and Shaft CDU registers (addresses 35 and 36 respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25 respectively) for the 80 second period during which the drift rate test was being performed.

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- 6.2.13.3 -continued-  
Calculate the drift rate by dividing the  $\Delta$ CDU angles by the elapsed time.  
The Trunnion drift rate shall be less than .0167 deg/sec.  
The shaft drift rate shall be less than .0333 deg/sec.
- 6.2.13.4 If OPTICS testing will not continue: set the G/N Power-Optics switch on the LEB Lighting Control Panel to OFF.
- 6.2.13.5 Optics Rate SF
- 6.2.13.5.1 Verify OPT H/C SLEW RATE & RATE SF K-Start Tape is on the tape reader to Section 00200. The tape numbers and their associated Flight Ropes are found in Appendix II. Start tape reader.
- 6.2.13.5.2 When tape reader stops, verify R1 = 00200.
- 6.2.13.5.3 Verify and/or set the following switches on the G & N Indicator Control Panel to the position indicated.  
(a) TEL TRUN to SLAVE to SXT  
(b) OPTICS COUPLING to DIRECT  
(c) OPTICS SPEED to LO  
(d) OPTICS MODE to MAN  
(e) OPTICS ZERO to OFF
- 6.2.13.5.4 Using the OPTICS CONTROL STICK and a convenient CONTROLLER SPEED switch setting, carefully slew the SXT trunnion to within +5 degrees of zero as indicated by the TPAC(Telescope Trunnion slaved to SXT). Set the OPTICS ZERO switch on the G & N Indicator Control Panel to ZERO. Wait 15 seconds. Set OPTICS SPEED to LO. Set OPTICS ZERO to OFF.
- 6.2.13.5.5 Start tape reader (KST-00201).
- 6.2.13.5.6 Wait approximately 35 seconds after tape reader stops for R1 = 00001. When R1 = 00001, start tape reader.
- 6.2.13.5.7 When tape reader stops, record contents of R1, R2 and R3. R1 is run number. R2 (Trunnion S. F.) shall be between 00221 and 00271. R3 (Shaft S. F.) shall be between 00447 and 00567.

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- 6.2.13.5.8 Start tape reader (KST-00203).
- 6.2.13.5.9 Wait approximately 35 seconds after tape reader stops for R1 = 00002.  
When R1 = 00002, start tape reader.
- 6.2.13.5.10 When tape reader stops record contents of R1, R2 and R3. R1 is run  
number. R2 (Trunnion S. F.) shall be between 00221 and 00271. R3  
(Shaft S. F.) shall be between 00447 and 00567.
- 6.2.13.5.11 Start tape reader (KST-00205).
- 6.2.13.5.12 Wait approximately 5 seconds after tape reader stops for R1 = 00003.  
When R1 = 00003, start tape reader.
- 6.2.13.5.13 When tape reader stops, record contents of R1, R2 and R3. R1 is run  
number. R2 (Trunnion S. F.) shall be between 00221 and 00271. R3 (Shaft  
S. F.) shall be between 00447 and 00567.
- 6.2.13.5.14 Start tape reader (KST-00207).
- 6.2.13.5.15 Wait approximately 5 seconds after tape reader stops for R1 = 00004.  
When R1 = 00004, start tape reader.
- 6.2.13.5.16 When tape reader stops, record contents of R1, R2 and R3, R1 is run  
number. R2 (Trunnion S. F.) shall be between 00221 and 00271. R3 (Shaft  
S. F.) shall be between 00447 and 00567.
- 6.2.13.5.17 Start tape reader (KST-00211).
- 6.2.13.5.18 Wait approximately 15 seconds after tape reader stops for R1 = 00005.  
When R1 = 00005, start tape reader.
- 6.2.13.5.19 When tape reader stops, record contents of R1, R2 and R3. R1 is run  
number. R2 (Trunnion S. F.) shall be between 00221 and 00271. R3  
(Shaft S. F.) shall be between 00447 and 00567.
- 6.2.13.5.20 Start tape reader (KST-00213).
- 6.2.13.5.21 Wait approximately 15 seconds after tape reader stops for R1 = 00006.  
When R1 = 00006, start tape reader.
- 6.2.13.5.22 When tape reader stops, record contents of R1, R2 and R3. R1 is run  
number. R2 (Trunnion S. F.) shall be between 00221 and 00271. R3  
(Shaft S. F.) shall be between 00447 and 00567.
- 6.2.13.5.23 Start tape reader. When tape reader stops, verify R1 = 00215. Test is  
terminated.

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- 6.2.13.5.24 Using the OPTICS CONTROL STICK and a convenient CONTROLLER SPEED switch setting, carefully slew the SXT Trunnion to within +5 degrees of zero as indicated by the TPAC (Telescope Trunnion slaved to SXT). Set the OPTICS ZERO switch to ZERO.

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- 6.2.14 Stabilization Loop Step Response Test
- 6.2.14.1 Proceed with this test if the Operate Power On Test of 6.2.3 has been performed and system operation has not been interrupted. If system operation has been interrupted, perform the Turn ON Procedure of 6.2.5.2 before proceeding.
- 6.2.14.2 Insure that the Carry-on Command Stimuli Unit, Model No. C14-200, is installed and connected.
- 6.2.14.3 Enter VERB 36 into K148. Press the ENTER pushbutton, then the ERROR RESET pushbutton.
- 6.2.14.4 Inner Gimbal Response Test.
- 6.2.14.4.1 Enter code 2032000000 in C-START Module 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2117 IGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.4.2 Enter VERB 41 NOUN 20 into K148. Press ENTER pushbutton.
- 6.2.14.4.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.4.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.4.5 Deleted.
- 6.2.14.4.6 Enter 0001 into R154. Verify and execute to apply +28 VDC ACE ENABLE to the PSAAM.
- 6.2.14.4.7 Enter 1000 into R155. Verify and execute to enter a DC step into the IG stabilization loop.
- CAUTION: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.4.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.4.9 Enter 0000 into 4A2-A6-R155; the top part of switch should be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the IG Stabilization Loop. The bottom part of switch shall be extinguished.
- 6.2.14.4.10 After the transient has died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to  $\pm 5\%$  of the original step amplitude. In addition, record the total number of overshoots.

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- 6.2.14.4.10.1 The inner gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.4.10.2 The maximum number of overshoots on the IGA Servo Error signals shall be three.
- 6.2.14.5 Middle Gimbal Response Test
- 6.2.14.5.1 Enter Code 2028000000 into C-START MODULE 4A1-A5-C156. Press the XEQ/SEAL pushbutton to call up CG 2147 MGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.5.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.5.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.5.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.5.5 Deleted.
- 6.2.14.5.6 Enter 0100 into 4A2-A6-R155. The top part of switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.5.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the MG Stabilization Loop.
- CAUTION: If the transient caused by the step input does not die within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.5.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.5.9 Enter 0000 into 4A2-A6-R155. The top part of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.
- 6.2.14.5.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to  $\pm 5\%$  of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.5.10.1 The middle gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.5.10.2 The maximum number of overshoots on the MGA Servo Error signals shall be three.



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- 6.2.14.6 Outer Gimbal Response Test
- 6.2.14.6.1 Enter code 2026000000 in C-START Module 4A1-A5-C156. Press XEQ/SEAL Pushbutton to call up CG 2177 OGA SERVO ERROR on 4A1-A3-CH1.
- 6.2.14.6.2 Enter VERB 41 NOUN 20 into K148. Press ENTER.
- 6.2.14.6.3 Enter +00000 into K148 three times. Press ENTER after each entry. Wait 30 seconds.
- 6.2.14.6.4 Enter VERB 40 NOUN 20 into K148. Wait 10 seconds.
- 6.2.14.6.5 Deleted.
- 6.2.14.6.6 Enter 0010 into 4A2-A6-R155. The top half of the switch shall be illuminated. Insure that no other function switches on 4A2-A6-R155 are illuminated.
- 6.2.14.6.7 Press XEQ/SEAL pushbutton on 4A2-A6-R155 to enter a DC step into the OG Stabilization Loops.
- NOTE: If the transient caused by the step input does not die out within 15 seconds, remove the IMU OPERATE power by setting the G/N POWER IMU switch on the LEB Lighting Control Panel to OFF.
- 6.2.14.6.8 Set up Analog Recorder 4A1-A3 using a chart speed of 100 mm/sec.
- 6.2.14.6.9 Enter 0000 into 4A2-A6-R155. The top half of the switch shall be extinguished. Insure that no other function switches on 4A2-A6-R155 are illuminated. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the OG Stabilization Loop.
- 6.2.14.6.10 After the transients have died out, stop the analog recorder. Record the loop response time by measuring the time interval between removing the step (initial disturbance) and the settling of the error signal to a value equal to  $\pm 5\%$  of the original step amplitude. In addition, record the total number of overshoots.
- 6.2.14.6.10.1 The outer gimbal stabilization loop response time shall be less than 0.1 second.
- 6.2.14.6.10.2 The maximum number of overshoots on the OGA Servo Error Signals shall be five.

- 6.2.14.7 Enter VERB 40 NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.14.7.1 Enter VERB 41 NOUN 20 into K148. Press the ENTER pushbutton.
- 6.2.14.7.2 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.3 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.4 Enter +00000 into K148. Press the ENTER pushbutton.
- 6.2.14.7.5 Enter 0000 into R154. Verify and execute to remove +28 VDC ACE ENABLE.

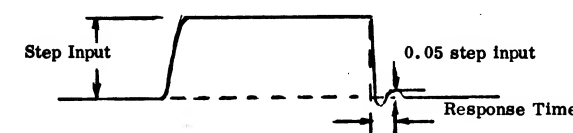


Figure 1. Typical Step Input Response

- 6.2.15 IRIG Scale Factor Test
- 6.2.15.1 Perform Master Initialization 6.2.5.3 before proceeding.
- 6.2.15.2 Verify that the IMU OPERATE power has been applied for a minimum of 1 hour, and that at least 1 hour has elapsed since running of the Gimbal Friction Test, 6.2.7.
- 6.2.15.3 Set up the Analog Recorders to monitor the following signals:
  - a. CG 2117 IG SERVO ERROR
  - b. CG 2147 MG SERVO ERROR
  - c. CG 2177 OG SERVO ERROR
  - d. CG 2120 IG TM CURRENT
  - e. CG 2150 MG TM CURRENT
  - f. CG 2180 OG TM CURRENT
- 6.2.15.3.1 Start the analog recorder chart drive using a chart speed of 1 mm/sec. The recorder shall run for the duration of 6.2.15.
- 6.2.15.4 Enter VERB 92 into K148. Press the ENTER pushbutton.
- 6.2.15.5 Enter 00005 into K148. Press the ENTER pushbutton. Program 07 shall be displayed.

6.2.15.6 VERB 06 NOUN 41 shall flash on CRT and the following displayed in R1 and R2:

R1 = ±xxxxx (some Nav. Base azimuth)  
R2 = ±xxxxx (some test site latitude; see table below).

6.2.15.7 If the values displayed in R1 and R2 are correct, proceed with test, if not perform the following sequence:

- a. To correct T1, on the K-148 enter VERB 21, press ENTER push-button, ±xxx.xx, press ENTER (±xxx.xx is correct nav. base azimuth).
- b. To correct R2, on the K-148 enter VERB 22, press ENTER push-button, ±xx.xxx, press ENTER (obtain correct site latitude from table below).

Verify that the values in R1 and R2 are correct.

| SITE       | LATITUDE |
|------------|----------|
| NAA        | +33.921  |
| MSC        | +29.556  |
| KSC MSO    | +28.523  |
| KSC VAB    | +28.585  |
| KSC PAD 39 | +28.607  |

6.2.15.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
+00001 ENTR

NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.8.

6.2.15.9 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+X IRIG Scale Factor error in part per million, Position +00001).

6.2.15.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
+00002 ENTR

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NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps of 6.2.15.4 through 6.2.15.7 and 6.2.15.10.

6.2.15.11 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (+Y IRIG Scale Factor Error in parts per million Position +00002).

6.2.15.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
+00003 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.12.

6.2.15.13 In approximately 160 seconds VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (-Z IRIG Scale Factor error in parts per million, Position +00003).

6.2.15.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
-00001 ENTR

NOTE: If PROG lamp changes from 06 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 38 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.14.

6.2.15.15 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row (-X IRIG Scale Factor error in parts per million, Position -00001).

6.2.15.16 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
-00002 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.2.15.4 through 6.2.15.7 and 6.2.15.16.

6.2.15.17 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per million, Position -00002).

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- 6.2.15.18 On K-148 enter the following sequence:  
VERB 33 ENTR (VERB 21 NOUN 97 shall flash)  
-00003 ENTR  
  
NOTE: If PROG lamp changes from 07 to 00 during the next step or  
PROG ALARM is ON, enter VERB 36 ENTR and repeat steps  
6.2.15.4 through 6.2.15.7 and 6.2.15.18.
- 6.2.15.19 In approximately 160 seconds, VERB 06 NOUN 98 shall flash. Read and  
record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per  
million, Position -00003).
- 6.2.15.20 Repeat steps 6.2.15.8 through 6.2.15.19 twice to obtain second and  
third set of data.
- 6.2.15.21 Terminate this test by entering in K-148: VERB 34 ENTER
- 6.2.15.22 The average of the three readings of Scale Factor Error for the 6 positions  
shall be  $0 \pm 1750$  PPM.
- 6.2.15.23 After completion of all test numbers, stop the analog recorders.
- 6.2.15.24 Enter VERB 40 NOUN 20, ENTER into K148.
- 6.2.15.25 Enter the following into K148:  
a. VERB 41 NOUN 20 ENTR  
b. +00000, ENTER  
c. +00000, ENTER  
d. +00000, ENTER

6.2.16 IMU Performance Test

6.2.16.1 Proceed with this test if the Operate Power On Test of 6.2.3 or the Turn On Procedure of 6.2.5.2 has been completed and system operation has not been interrupted. If the system operation has been interrupted, perform Turn On Procedure of 6.2.5.2 before proceeding with this test.

6.2.16.2 Verify that the IMU Operate Power has been applied for at least one hour.

6.2.16.3 On K-148, enter the following:

VERB 92 ENTR

6.2.16.4 Enter 00001 into K-148. Press the ENTER pushbutton.

6.2.16.5 On the CRT DSKY display VERB 06 NOUN 41 shall flash. Verify R1 (Nav Base Azimuth) and R2 (Site Latitude) are correct.

6.2.16.6 If values for R1 and R2 are correct, proceed to next step. If values for R1 and R2 are incorrect, enter the following sequence into K-148.

VERB 24 ENTR  
+XXX.XX ENTR (Correct navigation base azimuth  $\pm 0.50$  deg)  
+XX.XXX ENTR (Correct site latitude from table below)

Verify values in R1 and R2 are correct.

| Location | Latitude |
|----------|----------|
| NAA      | +33.921  |
| MSC      | +29.556  |
| KSC-MSO  | +28.523  |
| KSC-VAB  | +28.585  |
| KSC-PAD  | +28.607  |

6.2.16.7 On K-148, enter the following sequence:

VERB 33 ENTR  
VERB 06 NOUN 98 shall flash

6.2.16.8 On CRT DSKY display, verify R1 = +00900 (Time), R2 = +00000 (Test Index No.) and R3 = +00012 (Test Position). If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

VERB 25 ENTR  
+00900 ENTR (Test Time in Seconds)  
+00000 ENTR (Test Index Number)  
+00012 ENTR (Test Position Entry)

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- 6.2.16.9 On K-148, enter the following sequence:  
VERB 33 ENTR
- 6.2.16.10 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.11 On K-148, enter the following sequence:  
VERB 21 NOUN 01 ENTR  
02552 ENTR  
XXXXX ENTR (value of R2 from 6.2.16.10)  
VERB 34 ENTR  
VERB 06 NOUN 98 shall flash
- 6.2.16.12 On CRT DSKY displays, verify R1 = +00900, R2 = +00000, and R3 = +00002.  
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:  
VERB 25 ENTR  
+00900 ENTR (Test Time in Seconds)  
+00000 ENTR (Test Index Number)  
+00002 ENTR (Test Position Entry)
- 6.2.16.13 On K-148, enter the following sequence:  
VERB 33 ENTR
- 6.2.16.14 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.15 On K-148, enter the following sequence:  
VERB 33 ENTR
- 6.2.16.16 In approximately 90 seconds VERB 06 NOUN 98 shall flash. From the CRT, record R1 and R2.
- 6.2.16.17 On K-148, enter the following sequence:  
VERB 33 ENTR
- 6.2.16.18 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2. Record CRT CDU gimbal angle indications and time.
- 6.2.16.19 On K-148, enter the following sequence:  
VERB 34 ENTR  
VERB 06 NOUN 98 shall flash

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- 6.2.16.20 On CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00011.  
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00011  | ENTR (Test Position Entry)  |
- 6.2.16.21 On K-148, enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.22 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.23 On K-148, enter the following sequence:
- |         |                                   |
|---------|-----------------------------------|
| VERB 21 | NOUN 01 ENTR                      |
| 02554   | ENTR                              |
| XXXXX   | ENTR (value of R2 from 6.2.16.22) |
| VERB 34 | ENTR                              |
| VERB 06 | NOUN 98 shall flash               |
- 6.2.16.24 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00004.  
If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00004  | ENTR (Test Position Entry)  |
- 6.2.16.25 On K-148, enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.26 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.27 On K-148, enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.28 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.
- 6.2.16.29 On K-148, enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|



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- 6.2.16.30 In approximately 67 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.31 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 33 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.32 From the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00005.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00005  | ENTR (Test Position Entry)  |
- 6.2.16.33 Record Time. On K-148 enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.34 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset. The PROG alarm shall extinguish.
- 6.2.16.35 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, Record R1 and R2.
- 6.2.16.36 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.37 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00006.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2, and R3 are incorrect, enter the following sequence on K-148;
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00006  | ENTR (Test Position Entry)  |
- 6.2.16.38 Record Time. On K-148 enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

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- 6.2.16.39 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset. The PROG alarm lamp shall extinguish.
- 6.2.16.40 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.
- 6.2.16.41 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.42 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00007.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00007  | ENTR (Test Position Entry)  |
- 6.2.16.43 On K-148, enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.44 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.45 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.46 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00008.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00008  | ENTR (Test Position Entry)  |
- 6.2.16.47 On K-148, enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.48 In approximately 17 minutes VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

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- 6.2.16.49 On K-148, enter the following:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.50 On the CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00009.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00009  | ENTR (Test Position Entry)  |
- 6.2.16.51 On K-148, enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.52 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.53 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |
- 6.2.16.54 On the CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00010.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- |         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time in Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00010  | ENTR (Test Position Entry)  |
- 6.2.16.55 On K-148 enter the following sequence:
- |         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|
- 6.2.16.56 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.57 On K-148, enter the following sequence:
- |         |                     |
|---------|---------------------|
| VERB 34 | ENTR                |
| VERB 06 | NOUN 98 shall flash |

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6.2.16.58 On CRT DSKY display, verify R1 = +00900, R2 = +00000, and R3 = +00003.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

|         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time In Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00003  | ENTR (Test Position Entry)  |

6.2.16.59 On K-148, enter the following sequence:

|         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.60 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

6.2.16.61 On K-148 enter the following sequence:

|         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.62 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2. Row 1 is whole part, Row 2 is fractional part. Units are cm/sec<sup>2</sup>.

6.2.16.63 On K-148, enter the following sequence:

|         |                      |
|---------|----------------------|
| VERB 34 | ENTR                 |
| VERB 06 | NOUN 98 shall flash. |

6.2.16.64 On CRT DSKY displays, verify R1 = +00900, R2 = +00000, and R3 = +00001.

If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:

|         |                             |
|---------|-----------------------------|
| VERB 25 | ENTR                        |
| +00900  | ENTR (Test Time In Seconds) |
| +00000  | ENTR (Test Index Number)    |
| +00001  | ENTR (Test Position Entry)  |

6.2.16.65 On K-148, enter the following sequence:

|         |      |
|---------|------|
| VERB 33 | ENTR |
|---------|------|

6.2.16.66 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.

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- 6.2.16.67 On K-148 enter the following sequence:
- VERB 33    ENTR
- 6.2.16.68 In approximately 90 seconds, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R1 and R2.
- 6.2.16.69 On K-148, enter the following sequence:
- VERB 34    ENTR  
VERB 06    NOUN 98 shall flash
- 6.2.16.70 On CRT DSKY display, verify R1 = +00900, R2 = +00000 and R3 = +00013.
- If values for R1, R2 and R3 are correct, proceed to next step. If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- VERB 25    ENTR  
+00900    ENTR (Test Time in Seconds)  
+00000    ENTR (Test Index Number)  
+00013    ENTR (Test Position Entry)
- 6.2.16.71 On K-148, enter the following sequence:
- VERB 33    ENTR
- 6.2.16.72 In approximately 17 minutes, VERB 06 NOUN 98 shall flash. From the CRT DSKY display, record R2.
- 6.2.16.73 Terminate this test by entering the following into K-148:
- VERB 36    ENTR
- 6.2.16.74 On K-148 enter the following sequence:
- VERB 41    NOUN 20    ENTR  
+00000                ENTR  
+00000                ENTR  
+00000                ENTR

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6.2.16.75

Calculations

Position No. as  
Displayed in R3

Quantity Being Measured

|        |                                                                        |
|--------|------------------------------------------------------------------------|
| +00001 | +NBDY + ADOAY<br>+X PIPA G                                             |
| +00002 | +NBDZ - ADOAZ<br>-X PIPA G<br>-NBDX + ADIAX                            |
| +00003 | -NBDX - ADOAX<br>+Z PIPA G                                             |
| +00004 | +NBDY + ADSRAY<br>-Z PIPA G<br>+NBDZ + ADIAZ                           |
| +00005 | +Y PIPA G                                                              |
| +00006 | -Y PIPA G                                                              |
| +00007 | -NBDX + .707 (ADSRAX - ADOAX)                                          |
| +00008 | -.707 (NBDZ + NBDY)<br>+.5 (ADIAZ - ADIAY)<br>+.5 (ADSRAY + ADSRAZ)    |
| +00009 | -NBDZ + .707 (ADSRAX - ADOAZ)                                          |
| +00010 | .707 (NBDY - NBDX)<br>+.5 (ADIAZ - ADIAX)<br>+.5 (ADSRAX) + .5 (ADOAY) |
| +00011 | +NBDX - ADOAX                                                          |
| +00012 | +NBDY - ADOAY                                                          |
| +00013 | +NBDZ + ADOAZ                                                          |

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6.2.16.75.1 Measured Values

| Line | Position No. | Parameter                                                          | Recorded Value |
|------|--------------|--------------------------------------------------------------------|----------------|
| 1.   | +00001       | +NBDY + ADOAY                                                      | R2             |
| 2    | +00001       | +X PIPA G                                                          | R1 • R2        |
| 3    | +00002       | +NBDZ - ADOAZ                                                      | R2             |
| 4    | +00002       | -X PIPA G                                                          | R1 • R2        |
| 5    | +00002       | -NBDX + ADIAX                                                      | R2             |
| 6    | +00003       | -NBDX - ADOAX                                                      | R2             |
| 7    | +00003       | +Z PIPA G                                                          | R1 • R2        |
| 8    | +00004       | +NBDY + ADSRAY                                                     | R2             |
| 9    | +00004       | -Z PIPA G                                                          | R1 • R2        |
| 10   | +00004       | +NBDZ + ADIAZ                                                      | R2             |
| 11   | +00005       | +Y PIPA G                                                          | R1 • R2        |
| 12   | +00006       | -Y PIPA G                                                          | R1 • R2        |
| 13   | +00007       | -NBDX + .707 (ADSRAX - ADOAX)                                      | R2             |
| 14   | +00008       | .707 (-NBDZ - NBDY) + .5 (ADIAZ - ADIAY) + .5 (ADSRAY + ADSRAZ)    | R2             |
| 15   | +00009       | -NBDZ + .707 (ADSRAX - ADOAZ)                                      | R2             |
| 16   | +00010       | .707 (NBDY - NBDX) + .5 (ADIAZ - ADIAX) + .5 (ADSRAX) + .5 (ADOAY) | R2             |
| 17   | +00011       | +NBDX - ADOAX                                                      | R2             |
| 18   | +00012       | +NBDY - ADOAY                                                      | R2             |
| 19   | +00013       | +NBDZ + ADOAZ                                                      | R2             |

6.2.16.75.2 Y PIPA Data Correction Calculation

6.2.16.75.2.1 From the uplink file tape, the compressed data tape, or the PCM tape, request a data reduction of the X and Z accelerometer  $\Delta V$  counts (addresses 37 and 41, respectively) and the TIME 2 and TIME 1 registers (addresses 24 and 25, respectively) for the period during which the Y PIPA test was being performed in positions 5 and 6 of the IMU Performance test.

6.2.16.75.2.2 Perform the following calculations for position 5.

$$G'_5 = \frac{G_5}{\cos \theta y_5}$$

where:

$G_5$  = Measured acceleration term (line 11)

$G'_5$  = Corrected acceleration term

$\cos \theta y_5 = 1 - \frac{\theta^2 y_5}{2}$  for small angles

$$\theta y_5 = \sqrt{\theta^2_{x5} + \theta^2_{z5}}$$

and:

$$\theta_{z5} = (\Delta V_{x5} - \Delta V_x \text{ Bias}) (S.F._x) / (\Delta T)(\text{local } g)$$

$$\theta_{x5} = (\Delta V_{z5} - \Delta V_z \text{ Bias}) (S.F._z) / (\Delta T)(\text{local } g)$$

and:

$$\Delta V_x \text{ Bias} = (X \text{ PIPA Bias})(\Delta T)/S.F._x$$

$$\Delta V_z \text{ Bias} = (Z \text{ PIPA Bias})(\Delta T)/S.F._z$$

6.2.16.75.2.3 Perform the following calculations for position 6.

$$G'_6 = \frac{G_6}{\cos \theta y_6}$$

where:

$G_6$  = Measured acceleration term (line 12)

$G'_6$  = Corrected acceleration term

$\cos \theta y_6 = 1 - \frac{\theta^2 y_6}{2}$  for small angles



6.2.16.17.2.3  
(continued)

$$\theta_{y6} = \sqrt{\theta_{x6}^2 + \theta_{z6}^2}$$

and:

$$\theta_{z6} = (\Delta V_{x6} - \Delta V_{x \text{ Bias}})(S.F._x) / (\Delta T) \text{ (local g)}$$

$$\theta_{x6} = (\Delta V_{z6} - \Delta V_{z \text{ Bias}})(S.F._z) / (\Delta T) \text{ (local g)}$$

and:

$$\Delta V_{x \text{ Bias}} = (X \text{ PIPA Bias}) (\Delta T) / S.F._x$$

$$\Delta V_{z \text{ Bias}} = (Z \text{ PIPA Bias}) (\Delta T) / S.F._z$$

6.2.16.75.2.4 Compute the PIPA Scale Factor error in parts per million and record in Table X<sub>1</sub>.

$$a. \text{ PIPA S.F. Error} = \left[ \frac{2 \text{ local g}}{+PIPA G - (-PIPA G)} - 1.000000 \right] 10^6$$

$$b. \text{ X PIPA S.F. Error} = \left[ \frac{2 \text{ local g}}{\text{line 2} - \text{line 4}} - 1.000000 \right] 10^6$$

$$c. \text{ Y PIPA S.F. Error} = \left[ \frac{2 \text{ local g}}{G'_5 - G'_6} - 1.000000 \right] 10^6$$

$$d. \text{ Z PIPA S.F. Error} = \left[ \frac{2 \text{ local g}}{\text{line 7} - \text{line 9}} - 1.000000 \right] 10^6$$

The PIPA S.F. Error shall not exceed  $\pm 1900$  PPM

Local Gravity Values

| Location | Local Gravity (cm/sec <sup>2</sup> ) |
|----------|--------------------------------------|
| NAA      | 979.56                               |
| MSC      | 979.29                               |
| KSC      | 979.24                               |

6.2.16.75.2.5 Compute the PIPA Bias in cm/sec<sup>2</sup> and record in Table X<sub>1</sub>.

$$a. \text{ PIPA Bias} = \frac{+\text{PIPA G} + (-\text{PIPA G})}{2}$$

$$b. \text{ X PIPA Bias} = \frac{\text{line 2} + \text{line 4}}{2}$$

$$c. \text{ Y PIPA Bias} = \frac{G'_5 + G'_6}{2}$$

$$d. \text{ Z PIPA Bias} = \frac{\text{line 7} - \text{line 9}}{2}$$

The PIPA Bias shall not exceed  $\pm 2.28 \text{ cm/sec}^2$ .

6.2.16.75.2.6 Calculate NBD, ADOA, ADSRA, and ADIA.

$$a. \text{ NBDX} = \frac{-\text{line 6} + \text{line 17}}{2} =$$

$$\text{NBDY} = \frac{\text{line 1} + \text{line 18}}{2} =$$

$$\text{NBDZ} = \frac{\text{line 3} + \text{line 19}}{2} =$$

NBD shall not exceed  $\pm 15 \text{ meru}$ . Record values in Table X<sub>1</sub>.

$$b. \text{ ADOAX} = \frac{-\text{line 6} - \text{line 17}}{2} =$$

$$\text{ADOAY} = \frac{\text{line 1} - \text{line 18}}{2} =$$

$$\text{ADOAZ} = \frac{-\text{line 3} + \text{line 19}}{2} =$$

$$c. \text{ ADSRAX} = \frac{\text{line 13} + \text{NBDX}}{.707} + \text{ADOAX} =$$

$$\text{ADSRAY} = \text{line 8} - \text{NBDY} =$$

$$\text{ADSRZ} = \frac{\text{line 15} + \text{NBDZ}}{.707} + \text{ADOAZ} =$$

ADSRZ shall not exceed  $\pm 40 \text{ meru/g}$ . Record value in Table X<sub>1</sub>.

6.2.16.75.2.6 d. ADLAX = line 5 + NBDX =  
(continued)

$$ADLAX = \frac{\text{line 16} - .707(\text{NBDY} - \text{NBDX})}{.5} = \text{ADSRAX} + \text{ADLAX} - \text{ADOAY}$$

$$ADLAX = \text{line 10} - \text{NBDZ} =$$

ADLAX shall not exceed  $\pm 100$  meru/g. Record value in Table X<sub>1</sub>

6.2.16.75.2.7 Perform the following calculations for each term in Table X<sub>1</sub>, and record the results in Table D.

$$D_1 = |X_{i-1} - X_i|$$

$$D_2 = |X_{i-1} - X_i| + |X_{i-2} - X_{i-1}|$$

$$D_3 = |X_{i-3} - X_{i-2}| + |X_{i-2} - X_{i-1}| + |X_{i-1} - X_i|$$

X<sub>i</sub> = data point just obtained

X<sub>i-1</sub> = last historical data point

X<sub>i-2</sub> = second last historical data point

X<sub>i-3</sub> = third last historical data point

NOTE: D<sub>1</sub> calculations begin with the first data point after ISS pre-Vib;  
D<sub>2</sub> calculations begin with the second data point after ISS Pre-Vib;  
D<sub>3</sub> calculations begin with the third data point after Pre-Vib.

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6.2.16.75.3 Obtain data from last historical IRIG and PIPA test and complete Table X<sub>I-1</sub>.

TABLE X<sub>I-1</sub>

| PAREMETER          | UNITS               | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDX               | meru                |                |
| NBDY               | meru                |                |
| NBDZ               | meru                |                |
| ADSRAX             | meru/g              |                |
| ADSRAY             | meru/g              |                |
| ADSRAZ             | meru/g              |                |
| ADIAX              | meru/g              |                |
| ADIAZ              | meru/g              |                |
| X PIPA S. F. Error | PPM                 |                |
| Y PIPA S. F. Error | PPM                 |                |
| Z PIPA S. F. Error | PPM                 |                |
| X PIPA Bias        | cm/sec <sup>2</sup> |                |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                |

6.2.16.75.4 Obtain data from the second last historical IRIG and PIPA test and complete Table X<sub>1-2</sub>.

TABLE X<sub>1-2</sub>

| PARAMETER          | UNITS               | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDX               | meru                |                |
| NBDY               | meru                |                |
| NBDZ               | meru                |                |
| ADSRAX             | meru/g              |                |
| ADSRAY             | meru/g              |                |
| ADSRZ              | meru/g              |                |
| ADIAX              | meru/g              |                |
| ADIAZ              | meru/g              |                |
| X PIPA S. F. Error | PPM                 |                |
| Y PIPA S. F. Error | PPM                 |                |
| Z PIPA S. F. Error | PPM                 |                |
| X PIPA Bias        | cm/sec <sup>2</sup> |                |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                |

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6.2.16.75.5 Obtain data from the third last historical IRIG and PIPA test and complete Table X<sub>1-3</sub>.

TABLE X<sub>1-3</sub>.

| PARAMETER          | UNITS               | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDX               | meru                |                |
| NBDY               | meru                |                |
| NBDZ               | meru                |                |
| ADSRAX             | meru/g              |                |
| ADSRAY             | meru/g              |                |
| ADSRZ              | meru/g              |                |
| ADIAX              | meru/g              |                |
| ADIAZ              | meru/g              |                |
| X PIPA S. F. Error | PPM                 |                |
| Y PIPA S. F. Error | PPM                 |                |
| Z PIPA S. F. Error | PPM                 |                |
| X PIPA Bias        | cm/sec <sup>2</sup> |                |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                |

TABLE X<sub>1</sub>

| PARAMETER          | UNITS               | CALCULATED VALUE |
|--------------------|---------------------|------------------|
| NBDX               | meru                |                  |
| NBDY               | meru                |                  |
| NBDZ               | meru                |                  |
| ADSRAX             | meru/g              |                  |
| ADSRAY             | meru/g              |                  |
| ADSRAZ             | meru/g              |                  |
| ADIAx              | meru/g              |                  |
| ADIAy              | meru/g              |                  |
| ADIAz              | meru/g              |                  |
| X PIPA S. F. Error | PPM                 |                  |
| Y PIPA S. F. Error | PPM                 |                  |
| Z PIPA S. F. Error | PPM                 |                  |
| X PIPA Bias        | cm/sec <sup>2</sup> |                  |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                  |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                  |

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TABLE D

| PARAMETER          | UNITS               | D <sub>1</sub> | MAX | D <sub>2</sub> | MAX | D <sub>3</sub> | MAX |
|--------------------|---------------------|----------------|-----|----------------|-----|----------------|-----|
| NBDX               | meru                |                | 6   |                | 9   |                | 11  |
| NBDY               | meru                |                | 6   |                | 9   |                | 11  |
| NBDZ               | meru                |                | 6   |                | 9   |                | 11  |
| ADSRAX             | meru/g              |                | 14  |                | 21  |                | 25  |
| ADSRAY             | meru/g              |                | 14  |                | 21  |                | 25  |
| ADSRZ              | meru/g              |                | 14  |                | 21  |                | 25  |
| ADIAX              | meru/g              |                | 17  |                | 33  |                | 40  |
| ADIAY              | meru/g              |                | 17  |                | 33  |                | 40  |
| ADIAZ              | meru/g              |                | 17  |                | 33  |                | 40  |
| X PIPA S. F. Error | PPM                 |                | 400 |                | 500 |                | 600 |
| Y PIPA S. F. Error | PPM                 |                | 400 |                | 500 |                | 600 |
| Z PIPA S. F. Error | PPM                 |                | 400 |                | 500 |                | 600 |
| X PIPA Bias        | cm/sec <sup>2</sup> |                | 0.5 |                | 0.7 |                | 0.9 |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                | 0.5 |                | 0.7 |                | 0.9 |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                | 0.5 |                | 0.7 |                | 0.9 |

6.2.16.75.6 Failure to meet the above criteria shall result in retest according to 5.4.2.



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- 6.2.17 SXT-NB-Fine Alignment Test
- 6.2.17.1 Deleted
- 6.2.17.2 The G&N shall have had OPERATE power applied for a minimum of 1 hour.
- 6.2.17.3 Set the G/N POWER-OPTICS switch to OPTICS. Verify that +28 VDC OPTICS OPERATE BUS (CG 1530) is  $+28.0 \pm 3.0$  VDC. Verify that the OPTX 28V 800 cps 1% 0° ph (CG 1211) and OPTX 28V 800 cps 5% -90° ph (CG 1212) are not flashing on the CRT.
- 6.2.17.4 Deleted.
- 6.2.17.5 CAUTION: See Paragraph 5.1.2.11 before proceeding.  
On the G&N Indicator Control Panel set the following switches to the position indicated.
- a. OPTICS TEL TRUN to SLAVE to SXT
  - b. OPTICS COUPLING to DIRECT
  - c. OPTICS SPEED to LO
  - d. OPTICS MODE to MAN
  - e. OPTICS ZERO to ZERO
- 6.2.17.6 Deleted.
- 6.2.17.7 Deleted
- 6.2.17.8 Initiate the test by entering the following sequence into the LEB DSKY.
- a. VERB 92, ENTER
  - b. 00003, ENTER
- 6.2.17.9 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data is display in R1 and R2 on the DSKY.
- a. R1 = +13500
  - b. R2 = +xx.xxx (Site Latitude from table below)

| <u>SITE</u> | <u>LATITUDE</u> |
|-------------|-----------------|
| NAA         | +33.921         |
| MSC         | +29.556         |
| KSC MSO     | +28.523         |
| KSC VAB     | +28.585         |
| KSC PAD 39  | +28.607         |

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- 6.2.17.10 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If the value displayed is other than +13500 in R1 and the correct Site Latitude in R2, correct the data by entering the following sequence into the DSKY.
- VERB 21, ENTER
  - +13500, ENTER
  - VERB 22, ENTER
  - +xx.xxx, ENTER (+xx.xxx = Site Latitude from table above)
  - VERB 33, ENTER
- 6.2.7.11 Observe VERB 25 NOUN 97 flashing on the DSKY. Enter the following sequence into the DSKY.
- +00001, ENTER (Position Number)
  - +00000, ENTER
  - +00001, ENTER
- 6.2.17.12 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- R1 = +xxx.xx ( $Y_{NB}$  Azimuth)
  - R2 = ±xx.xxx ( $Y_{NB}$  Elevation)
  - R3 = 00001
- 6.2.17.13 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct  $Y_{NB}$  azimuth and elevation, correct the data by entering the following sequence into the DSKY.
- VERB 24, ENTER
  - +xxx.xx±002.00 degrees, ENTER ( $Y_{NB}$  Azimuth)
  - +xx.xxx±02.000 degrees, ENTER ( $Y_{NB}$  Elevation)
  - VERB 33, ENTER
- 6.2.17.14 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- R1 = +xxx.xx ( $Z_{NB}$  Azimuth)
  - R2 = ±xx.xxx ( $Z_{NB}$  Elevation)
  - R3 = 00002
- 6.2.17.15 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct  $Z_{NB}$  azimuth and elevation, correct the data by entering the following sequence into the DSKY.
- VERB 24, ENTER
  - +xxx.xx±002.00 degrees, ENTER ( $Z_{NB}$  Azimuth)
  - +xx.xxx±02.000 degrees, ENTER ( $Z_{NB}$  Elevation)
  - VERB 33, ENTER

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- 6.2.17.16 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- a. R1 = +xxx.xx (Target 1 Azimuth)
  - b. R2 = +xx.xxx (Target 1 Elevation)
  - c. R3 = 00001
- 6.2.17.17 If the data displayed is correct enter VERB 33 ENTER into the DSKY. If R1 and R2 do not contain the correct azimuth and elevation for Target 1, correct the data by entering the following sequence into the DSKY.
- a. VERB 24, ENTER
  - b. +xxx.xx±000.10 degrees, ENTER (Target 1 Azimuth)
  - c. ±xx.xxx±00.010 degrees, ENTER (Target 1 Elevation)
  - d. VERB 33, ENTER
- 6.2.17.18 Observe VERB 06 NOUN 41 flashing on the DSKY. The following data shall be displayed in R1, R2 and R3.
- a. R1 = +xxx.xx (Target 2 Azimuth)
  - b. R2 = ±xx.xxx (Target 2 Elevation)
  - c. R3 = 00002
- 6.2.17.19 If the data displayed is correct proceed to 6.2.17.22. If R1 and R2 do not contain the correct azimuth and elevation for Target 2, correct the data by entering the following sequence into the DSKY.
- a. VERB 24, ENTER
  - b. +xxx.xx±000.10 degrees, ENTER (Target 2 Azimuth)
  - c. ±xx.xxx±00.010 degrees, ENTER (Target 2 Elevation)
- 6.2.17.20 CAUTION: See Paragraph 5.1.2.11 before proceeding. Set the OPTICS ZERO switch to OFF. Enter VERB 33, ENTER into the DSKY.
- 6.2.17.21 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00001, on the DSKY set the OPTICS MODE switch on the G&N Indicator Control Panel to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.
- 6.2.17.22 Using the Optics Hand Controller, align the SXT StLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.

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- 6.2.17.23 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement of the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.24 Using the Optics Hand Controller, align the SXT StLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- NOTE: The following two MARKS must be performed as quickly as possible. In no case shall the time between the first and second MARK exceed two minutes.
- 6.2.17.25 After 20 seconds observe the DSKY for VERB 51 and NOUN 70 flashing and R1 = 00001. Set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 1 position. When the alignment is complete as observed by no further movement of the Telescope Panel Angle Counters (TPAC), set the OPTICS MODE switch to MANUAL.
- 6.2.17.26 Using the Optics Hand Controller, align the SXT StLOS with Target 1 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.27 When the DSKY displays VERB 51 NOUN 70 flashing and R1 = 00002, set the Optics Mode switch to CMC. The CMC will align the SXT to the Target 2 position. When alignment is complete as observed by no further movement to the TPAC, set the OPTICS MODE switch to MANUAL.
- 6.2.17.28 Using the Optics Hand Controller, align the SXT StLOS with Target 2 and press the MARK pushbutton. If satisfied that the MARK was good press the ENTER pushbutton. If not satisfied with the MARK press the MARK REJECT pushbutton and repeat this step. Observe VERB 50 NOUN 25 flashing and R1 = 00016. Press the ENTER pushbutton.
- 6.2.17.29 In approximately 7 minutes VERB 06 NOUN 98 shall flash on the DSKY and the test results shall be displayed. R1 and R2 on the DSKY shall display the misalignment of one of the horizontal PIPA's in arc seconds (R1 = whole, R2 = fractional). Record R1 and R2. (See Table IV for PIPA displayed.)
- 6.2.17.30 Enter VERB 33 ENTER into the DSKY. When VERB 06 NOUN 98 flashes R1 and R2 on the DSKY shall display the misalignment of the second horizontal PIPA in arc seconds (R1 whole, R2 fractional). (See Table IV for PIPA displayed). Record R1 and R2.

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- 6.2.17.31 Enter VERB 34 ENTER into the DSKY to terminate the test. Wait 5 seconds.
- 6.2.17.32 Repeat steps 6.2.17.4 and 6.2.17.8 through 6.2.17.31 substituting No.00002 in 6.2.17.11.a.
- 6.2.17.33 Enter the following sequence into the DSKY:
- VERB 36, ENTER
  - VERB 41 NOUN 20, ENTER
  - +00000, ENTL1
  - +00000, ENTER
  - +00000, ENTER
- 6.2.17.34 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OFF.

Table IV. DISPLAY CONDITIONS AT TEST COMPLETION

| Position | SM Orientation  |                 |                 | Horizontal Misalignment Component |                 |
|----------|-----------------|-----------------|-----------------|-----------------------------------|-----------------|
|          | X <sub>SM</sub> | Y <sub>SM</sub> | Z <sub>SM</sub> | 6.2.17.29                         | 6.2.17.30       |
| 1.       | UP              | SW              | SE              | Y <sub>SM</sub>                   | Z <sub>SM</sub> |
| 2.       | SE              | SW              | DN              | X <sub>SM</sub>                   | Y <sub>SM</sub> |
| 3.*      | SE              | UP              | SW              | X <sub>SM</sub>                   | Z <sub>SM</sub> |

\* Position 3 is not run in the Spacecraft because of GIMBAL LOCK considerations.

6.2.17.35 Calculations

- 6.2.17.35.1
- $Y_{SM} \text{ misalignment} = ( ) \frac{R1.R2}{}$
  - $Z_{SM} \text{ misalignment} = ( ) \frac{R1.R2}{}$
  - $X_{SM} \text{ misalignment} = ( ) \frac{R1.R2}{}$
  - $Y_{SM} \text{ misalignment} = ( ) \frac{R1.R2}{}$

6.2.17.35.2 Enter the latest values from 6.2.16 IMU Performance Test.

- X PIPA bias =                      cm/sec<sup>2</sup>
- Y PIPA bias =                      cm/sec<sup>2</sup>
- Z PIPA bias =                      cm/sec<sup>2</sup>
- $\theta_x = 210 \text{ (X PIPA bias)} = \underline{\hspace{2cm}}$  arc sec.
- $\theta_y = 210 \text{ (Y PIPA bias)} = \underline{\hspace{2cm}}$  arc sec.
- $\theta_z = 210 \text{ (Z PIPA bias)} = \underline{\hspace{2cm}}$  arc sec.

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- 6.2.17.35.3 a.  $Y_{SM}$  misalignment (Bias corrected) = 6.2.17.35.1a -  $\theta_y$  = \_\_\_\_\_ arc sec.  
b.  $Z_{SM}$  misalignment (Bias corrected) = 6.2.17.35.1b -  $\theta_z$  = \_\_\_\_\_ arc sec.  
c.  $X_{SM}$  misalignment (Bias corrected) = 6.2.16.35.1c -  $\theta_x$  = \_\_\_\_\_ arc sec.  
d.  $Y_{SM}$  misalignment (Bias corrected) = 6.2.17.35.1d -  $\theta_y$  = \_\_\_\_\_ arc sec.

The SM misalignment in each orientation, excluding PIPA bias, shall not exceed  $\pm 150$  arc seconds.

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6.2.18 Gyrocompassing Test

6.2.18.1 Set the G/N POWER-OPTICS switch on the LEB Lighting Control Panel to OPTICS. Verify that +28 vdc OPTICS OPERATE BUS (CG 1530) is +28.0±3.0 vdc. Verify that the OPTX 28V 800 cps 1% 0° (CG 1211) and OPTX 28V 800 cps 5%-90° (CG 1212) are not flashing in the CRT.

6.2.18.2 Load the Inertial Instrument Calibration Data into the CMC using the following sequence:

|                      |         |      |
|----------------------|---------|------|
| VERB 21              | NOUN 01 | ENTR |
| 01716                |         | ENTR |
| XXXXX (X PIPA BIAS)  |         | ENTR |
|                      |         | ENTR |
| 01717                |         | ENTR |
| XXXXX (X PIPA S. F.) |         | ENTR |
|                      |         | ENTR |
| 01720                |         | ENTR |
| XXXXX (Y PIPA BIAS)  |         | ENTR |
|                      |         | ENTR |
| 01721                |         | ENTR |
| XXXXX (Y PIPA S. F.) |         | ENTR |
|                      |         | ENTR |
| 01722                |         | ENTR |
| XXXXX (Z PIPA BIAS)  |         | ENTR |
|                      |         | ENTR |
| 01723                |         | ENTR |
| XXXXX (Z PIPA S. F.) |         | ENTR |
|                      |         | ENTR |
| 01724                |         | ENTR |
| XXXXX (NBDX)         |         | ENTR |
|                      |         | ENTR |
| 01725                |         | ENTR |
| XXXXX (NBDY)         |         | ENTR |
|                      |         | ENTR |
| 01726                |         | ENTR |
| XXXXX (NBDZ)         |         | ENTR |
|                      |         | ENTR |
| 01727                |         | ENTR |
| XXXXX (ADIAX)        |         | ENTR |
|                      |         | ENTR |
| 01730                |         | ENTR |
| XXXXX (ADIAZ)        |         | ENTR |
|                      |         | ENTR |
| 01731                |         | ENTR |
| XXXXX (ADIAZ)        |         | ENTR |
|                      |         | ENTR |
| 01732                |         | ENTR |
| XXXXX (ADSRAX)       |         | ENTR |

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6.2.18.2  
(Continued)

|                |      |
|----------------|------|
| 01733          | ENTR |
| XXXXX (ADSRAY) | ENTR |
|                | ENTR |
| 01734          | ENTR |
| XXXXX (ADSRAZ) | ENTR |

6.2.18.3 Enter NB Azimuth and Site Latitude (from table below) and Launch Azimuth into the CMC using the following sequence:

|         |         |                                   |
|---------|---------|-----------------------------------|
| VERB 21 | NOUN 01 | ENTR                              |
| 2506    |         | ENTR (NB Azimuth)                 |
| XXXXX   |         | ENTR (fraction of a Rev Hi order) |
|         |         | ENTR                              |
| 2507    |         | ENTR (NB Azimuth)                 |
| XXXXX   |         | ENTR (fraction of a Rev Lo order) |
|         |         | ENTR                              |
| 2510    |         | ENTR (Site Latitude)              |
| XXXXX   |         | ENTR (fraction of a Rev Hi order) |
|         |         | ENTR                              |
| 2511    |         | ENTR (Site Latitude)              |
| XXXXX   |         | ENTR (fraction of a Rev Lo order) |
|         |         | ENTR                              |
| 2755    |         | ENTR (Launch Azimuth)             |
| XXXXX   |         | ENTR (fraction of a Rev Hi order) |
|         |         | ENTR                              |
| 2756    |         | ENTR (Launch Azimuth)             |
| XXXXX   |         | ENTR (fraction of a Rev Lo order) |

| <u>Location</u> | <u>Latitude (Fraction of a Rev)</u><br><u>Hi Order</u> | <u>Low Order</u> |
|-----------------|--------------------------------------------------------|------------------|
| NAA             | 03007                                                  | 36671            |
| MSC             | 02423                                                  | 23341            |
| KSC MSO         | 02422                                                  | 04033            |
| KSC VAB         | 02424                                                  | 36151            |
| KSC PAD 39      | 02425                                                  | 37327            |

6.2.18.4 Enter the following into the CMC:

VERB 37 ENTER, 01 ENTER



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- 6.2.18.5 When PROG display changes to 02, record time as  $T_0$ .
- 6.2.18.6 Gyro Compassing Accuracy
- 6.2.18.6.1 CAUTION: See Paragraph 5.1.2.11 before proceeding. After 120 minutes from  $T_0$ , set the OPTICS ZERO switch on the G&N Indicator to ZERO. Record Inner, Middle and Outer Gimbal CDU readings every 5 minutes for the next 2 hours.
- 6.2.18.6.2 Enter VERB 65, ENTER into DSKY.  
Observe the PROGRAM display on the DSKY change to 03.
- 6.2.18.6.3 When VERB 06 NOUN 41 flashes on the DSKY, insure R1 and R2 display Target 1 azimuth and elevation.
- a. R1 = +XXX.XX (Target 1 azimuth)
  - b. R2 = +XX.XXX (Target 1 elevation)
  - c. R3 = 00001
- 6.2.18.6.4 Verify the data appearing in R1 and R2 and if correct, proceed. If not correct, perform the following sequence:
- a. VERB 24, ENTER
  - b. +XXX.XX, ENTER (Target 1 azimuth)
  - c. +XX.XXX, ENTER (Target 1 elevation)
- 6.2.18.6.5 After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY.
- 6.2.18.6.6 When VERB 06 NOUN 41 flashes on the DSKY, insure that R1 and R2 display Target 2 azimuth and elevation.
- a. R1 = XXX.XX (Target 2 azimuth)
  - b. R2 = XX.XXX (Target 2 elevation)
  - c. R3 = 00002.
- 6.2.18.6.7 Verify the data appearing in R1 and R2 and if correct, perform the following sequence:
- a. VERB 24, ENTER
  - b. +XXX.XX, ENTER (Target 2 azimuth)
  - c. +XX.XXX, ENTER (Target 2 elevation)

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- 6.2.18.6.8 After the correct readings for R1 and R2 are verified, enter VERB 33, ENTER into the DSKY.
- 6.2.18.6.9 Using the Optics Hand Controller, align the SXT StLOS to Target 1 and press MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied with MARK, press MARK REJECT pushbutton and repeat this step.
- 6.2.18.6.10 Set the OPTICS SPEED switch to HI. Using the Optics Hand Controller, drive the SXT StLOS to the approximate position of Target 2.
- 6.2.18.6.11 Set the OPTICS SPEED switch to LO. Using the Optics Hand Controller, align the SXT StLOS to Target 2 and press the MARK pushbutton. If satisfied that the MARK was good, press the ENTER pushbutton. If not satisfied, press the MARK REJECT pushbutton and repeat this step.
- 6.2.18.6.12 On the DSKY observe the following data displayed:
- a. VERB 06 NOUN 93
  - b. R1 =  $\pm$ XX.XXX (X gyro elevation error)
  - c. R2 =  $\pm$ XX.XXX (Y gyro elevation error)
  - d. R3 =  $\pm$ XX.XXX (Z gyro azimuth error)
- Record R1, R2 and R3. The X and Y gyro elevation error shall be  $0.00 \pm 0.55$  degrees, and the Z gyro azimuth error shall be  $0.00 \pm 0.3$  degrees.
- 6.2.18.6.13 CAUTION: See Paragraph 5.1.2.11 before proceeding.
- Enter VERB 34 ENTER into the DSKY. Observe the PROGRAM display change to 02. Set the OPTICS ZERO switch on the G&N Indicator Control Panel to ZERO. Immediately repeat Steps 6.2.18.6.2 through 6.2.18.6.13 twice.
- 6.2.18.6.14 Repeat Steps 6.2.18.6.2 through 6.2.18.6.13 at 150, 180 and 210 minutes from  $T_0$ .
- 6.2.18.6.15 Enter VERB 36 into the DSKY. Press the ENTER pushbutton.
- 6.2.18.6.16 Enter VERB 41 NOUN 20 into the DSKY. Press the ENTER pushbutton. Enter +00000 into the DSKY three times. Press the ENTER pushbutton after each entry. Set the G&N POWER OPTICS switch on the LEB Lighting Control Panel to OFF.

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- 6.2.18.7 Gyrocompassing Stability
- 6.2.18.7.1 Calculate the average of the first three X and Y gyro elevation errors and the first three Z gyro azimuth errors.
- 6.2.18.7.2 The last three X and Y gyro elevation errors shall not deviate from the baseline X and Y gyro elevation errors determined above by more than  $\pm 0.15$  degrees.
- 6.2.18.7.3 The last three Z gyro azimuth errors shall not deviate from the baseline Z gyro azimuth error determined above by more than  $\pm 0.06$  degrees.

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- 6.2.19 CMC Voltage Margin Test
- 6.2.19.1 Verify that the G&N IMU HTR MNA & MNB circuit breakers are engaged, Computer NMA & NMB breakers are engaged, IMU MNA & MNB circuit breakers are not engaged, and the G&N Power - IMU switch on the LEB Lighting Control Panel is in the OFF position.
- 6.2.19.2 On the PSA Adapter Module set the INHIBIT VOLTAGE FAIL switch to ON.
- Caution: During the performance of this test the +4 VDC CMC Power Supply shall not be operated at less than +2.5 VDC or greater than 5.2 VDC (CG 1030). The +14 VDC CMC Power Supply shall not be operated at less than +8.5 VDC or greater than +17.0 VDC (CG 1020). Rotate the LEB LTS NUMERICS SEL to approximately center position. Decrease to absolute minimum discernible lighting.
- Note: The flashing indication of the CMC Power Supplies on CRT may be disregarded for this test. The charts in Table V may be used to determine approximate values for the "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.
- 6.2.19.3 Into R154 insert 0001. Verify and execute.
- 6.2.19.3.1 Into R153 insert 1100. Verify and execute.
- 6.2.19.4 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.5 Into C156 insert -050001234. Verify and execute. Verify on the CRT that GV0106 is between -4.0 and -6.0 VDC.
- 6.2.19.6 Into R154 insert 0111. Verify and execute.
- 6.2.19.7 Observe CG 1020, +14 VDC CMC Power Supply and CG 1030, +4 VDC CMC Power Supply, on the CRT. Repeat 6.2.19.3 through 6.2.19.6 adjusting each C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC and CG 1030 is +3.40 (+0.03 - 0.00) VDC.
- 6.2.19.8 Initiate CMC Self Check by inserting the following into K148:
- a. ERROR RESET
  - b. VERB 21 NOUN 27, ENTER
  - c. 77777, ENTER
- Wait 200 seconds

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- 6.2.19.9 Insure that the DSKY RESTART lamp and Program Alarm lamp does not light.
- 6.2.19.9.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.10 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify the RESTART lamp on the DSKY is lighted. Disregard other DSKY indications. If RESTART does not light, repeat 6.2.19.3. Verify CMC Warning masters alarm are lighted.
- 6.2.19.11 On PSAAM, set INHIBIT VOLTAGE FAIL switch ON.  
On K-148, enter the following:
- VERB 01 NOUN 10 ENTR  
00077 ENTR
- Verify DSKY Row 1 display has Bit 6 on. Other combinations of bits are permissible, but Bit 6 must be on.
- 6.2.19.11.1 On K-148, enter the following sequence:
- VERB 21 NOUN 10 ENTR  
00077 ENTR  
00000 ENTR  
Press RSET  
VERB 21 NOUN 27 ENTR  
77777 ENTR
- 6.2.19.12 Into R154 insert 00001. Verify and execute.
- 6.2.19.13 Into C156 insert +108001244. Verify and execute. Verify on the CRT that GV0116 is between +9.8 and +11.8 VDC.
- 6.2.19.14 Into R154 insert 0111. Verify and execute.
- 6.2.19.15 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.12 through 6.2.19.14 adjusting the C-Start entry until CG 1020 is 16.4 (+0.1, -0.0) VDC.
- 6.2.19.16 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.16.1 Into R154 insert 0011. Verify and execute.
- 6.2.19.17 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted.

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- 6.2.19.18 On PSAAM, set INHIBIT VOLTAGE FAIL switch ON.  
On K-148, enter the following:
- VERB 01 NOUN 10 ENTR  
00077 ENTR
- Verify DSKY Row 1 display has Bit 6 on. Other combinations of bits are permissible, but Bit 6 must be on.
- 6.2.19.18.1 On K-148, enter the following sequence:
- VERB 21 NOUN 10 ENTR  
00077 ENTR  
00000 ENTR  
Press RSET  
VERB 21 NOUN 27 ENTR  
77777 ENTR
- 6.2.19.19 Into R154 insert 0001. Verify and execute.
- 6.2.19.20 Into C156 enter +092001234. Verify and execute. Verify on the CRT that GV0106 is between +8.2 and +10.2 VDC.
- 6.2.19.21 Into R154 insert 0111. Verify and execute.
- 6.2.19.22 Observe CG 1030, +4 VDC CMC Power Supply on the CRT. Repeat 6.2.19.21 adjusting the C-Start entry until CG 1030 is +4.60 (+0.03, -0.00) VDC.
- 6.2.19.23 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.23.1 Into R154 insert 0101. Verify and execute.
- 6.2.19.24 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Verify CMC Warning master alarms are lighted.
- 6.2.19.25 On PSAAM, set INHIBIT VOLTAGE FAIL switch ON.  
On K-148, enter the following:
- VERB 01 NOUN 10 ENTR  
00077 ENTR
- Verify DSKY Row 1 display has Bit 6 on. Other combinations of bits are permissible, but Bit 6 must be on.

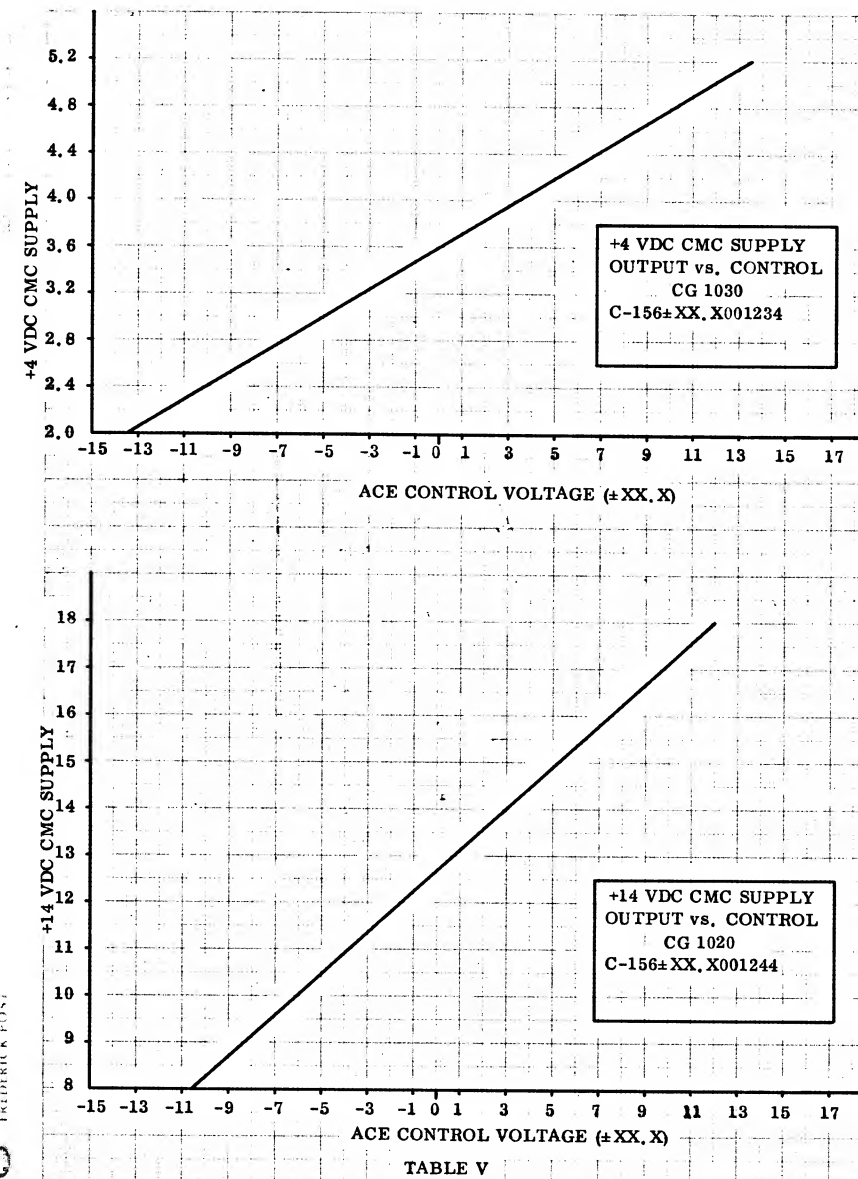
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- 6.2.19.25.1 On K-148, enter the following sequence:
- |         |         |      |
|---------|---------|------|
| VERB 21 | NOUN 10 | ENTR |
| 00077   |         | ENTR |
| 00000   |         | ENTR |
| Press   |         | RSET |
| VERB 21 | NOUN 27 | ENTR |
| 77777   |         | ENTR |
- 6.2.19.26 Into R154 insert 0001. Verify and execute.
- 6.2.19.27 Into C156 insert -040001244. Verify and execute. Verify on the CRT that GV0116 is between -3.0 and -5.0 VDC.
- 6.2.19.28 Into R154 insert 0111. Verify and execute.
- 6.2.19.29 Observe CG 1020, +14 VDC CMC Power Supply on the CRT. Repeat 6.2.19.26 through 6.2.19.28 adjusting the C-Start entry until CG 1020 is +12.1 (+0.1, -0.0) VDC.
- 6.2.19.30 Press ERROR RESET on K148. Wait 200 seconds. Ensure that the DSKY RESTART lamp and PROGRAM ALARM lamp does not light.
- 6.2.19.30.1 Into R154 insert 0011. Verify and execute.
- 6.2.19.31 Set the INHIBIT VOLTAGE FAIL switch on the PSAAM to OFF. Verify that the DSKY RESTART lamp is lighted. Disregard other DSKY indications. Verify CMC Warning master alarms are lighted.
- 6.2.19.32 Into R154 insert 0000. Verify and execute.
- 6.2.19.33 On K-148, enter the following:
- |         |         |      |
|---------|---------|------|
| VERB 01 | NOUN 10 | ENTR |
| 00077   |         | ENTR |
- Verify DSKY Row 1 display has Bit 6 on. Other combinations of bits are permissible, but Bit 6 must be on.
- 6.2.19.33.1 Terminate CMC Self Check by inserting into K-148:
- |         |         |      |
|---------|---------|------|
| VERB 21 | NOUN 10 | ENTR |
| 00077   |         | ENTR |
| 00000   |         | ENTR |
| Press   |         | RSET |
| VERB 21 | NOUN 27 | ENTR |
| 00000   |         | ENTR |

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6.2.19.34      Ensure that CG 1020, +14 VDC CMC Power Supply indication, is  $+14.0 \pm 0.4$  and  
that CG 1030, +4 VDC CMC Power Supply indication is  $+4.00 \pm 0.20$  VDC on  
the CRT.





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- 6.2.20      Spacecraft Control and Displays Test.
- 6.2.20.1    Proceed with this test if the Operate Power on Test of 6.2.3 and system operation has not been interrupted. If system operation has been interrupted, perform 6.2.5.2 before proceeding.
- 6.2.20.2    FDAI Attitude Error.
- 6.2.20.2.1   Insert in KI48
- a. V92      ENTER  
        b. 00013    ENTER
- 6.2.20.2.2   Observe on the CRT PROG 07. In approximately 5 sec observe NO ATT ON. In approximately 20 sec observe V06 NO1 flashing and R1, R2 and R3 approximately 00000.
- 6.2.20.2.3   Insert in KI48
- a. VERB 33, ENTER
- 6.2.20.2.4   Observe on CRT
- a. V06      N 01    Flashing  
        b. R1            +00385  
        c. R2            -00385  
        d. R3            +00385  
        e. NO ATT        OFF
- 6.2.20.2.5   Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT    +5.06±0.50V rms  
        b. CG 2219 PITCH ATT ERROR - CDU DAC OUT   -5.06±0.50V rms  
        c. CG 2249 YAW ATT ERROR - CDU DAC OUT    +5.06±0.50V rms
- 6.2.20.2.6   Insert in KI48
- a. VERB 33,    ENTER
- 6.2.20.2.7   Observe on CRT
- a. V06      N01    Flashing  
        b. R1            +00384  
        c. R2            -00384  
        d. R3            +00384

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- 6.2.20.2.8 Record CRT indications.
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +5.06±0.50V rms
  - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -5.06±0.50V rms
  - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +5.06±0.50V rms
- 6.2.20.2.9 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.10 Observe on CRT
- a. V06 N01 Flashing
  - b. R1 +00160
  - c. R2 -00160
  - d. R3 +00160
- 6.2.20.2.11 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +2.11±0.21V rms
  - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -2.11±0.21V rms
  - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +2.11±0.21V rms
- 6.2.20.2.12 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.2.13 Observe on CRT
- a. V06 N01 Flashing
  - b. R1 +00135
  - c. R2 -00135
  - d. R3 +00135
- 6.2.20.2.14 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +1.78±0.18V rms
  - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -1.78±0.18V rms
  - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +1.78±0.18V rms
- 6.2.20.2.15 Insert in K148
- a. VERB 33, ENTER

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- 6.2.20.2.16 Observe on CRT.
- a. V06 N01 Flashing
  - b. R1 +00090
  - c. R2 -00090
  - d. R3 +00090
- 6.2.20.2.17 Record CRT indications.
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT +1.19±0.12V rms
  - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT -1.19±0.12V rms
  - c. CG 2249 YAW ATT ERROR - CDU DAC OUT +1.19±0.12V rms
- 6.2.20.2.18 Insert in K148.
- a. VERB 33, ENTER
- 6.2.20.2.19 Observe on CRT.
- a. V06 N01 Flashing
  - b. R1 +00000
  - c. R2 +00000
  - d. R3 -00090
- 6.2.20.2.20 Record CRT indications.
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT 0.00±0.06V rms
  - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT 0.00±0.06V rms
  - c. CG 2249 YAW ATT ERROR - CDU DAC OUT -1.19±0.12V rms
- 6.2.20.2.21 Insert in K148.
- a. VERB 33, ENTER
- 6.2.20.2.22 Observe on CRT.
- a. V06 N01 Flashing
  - b. R1 -00090
  - c. R2 +00090
  - d. R3 -00135
- 6.2.20.2.23 Record CRT indications
- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT -1.19±0.12V rms
  - b. CG 2219 PITCH ATT ERROR - CDU DAC OUT +1.19±0.12V rms
  - c. CG 2249 YAW ATT ERROR - CDU DAC OUT -1.79±0.18V rms

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6.2.20.2.24 Insert in K148

a. VERB 33, ENTER

6.2.20.2.25 Observe on CRT

|    |     |     |          |
|----|-----|-----|----------|
| a. | V06 | N01 | Flashing |
| b. | R1  |     | -00135   |
| c. | R2  |     | +00135   |
| d. | R3  |     | -00160   |

6.2.20.2.26 Record CRT indications

|    |         |                               |                 |
|----|---------|-------------------------------|-----------------|
| a. | CG 2279 | ROLL ATT ERROR - CDU DAC OUT  | -1.78±0.18V rms |
| b. | CG 2219 | PITCH ATT ERROR - CDU DAC OUT | +1.78±0.18V rms |
| c. | CG 2249 | YAW ATT ERROR - CDU DAC OUT   | -2.11±0.21V rms |

6.2.20.2.27 Insert in K148

a. VERB 33, ENTER

6.2.20.2.28 Observe on CRT

|    |     |     |          |
|----|-----|-----|----------|
| a. | V06 | N01 | Flashing |
| b. | R1  |     | -00160   |
| c. | R2  |     | +00160   |
| d. | R3  |     | -00384   |

6.2.20.2.29 Record CRT indications

|    |         |                               |                 |
|----|---------|-------------------------------|-----------------|
| a. | CG 2279 | ROLL ATT ERROR - CDU DAC OUT  | -2.11±0.21V rms |
| b. | CG 2219 | PITCH ATT ERROR - CDU DAC OUT | +2.11±0.21V rms |
| c. | CG 2249 | YAW ATT ERROR - CDU DAC OUT   | -5.06±0.50V rms |

6.2.20.2.30 Insert K148

a. VERB 33, ENTER

6.2.20.2.31 Observe on CRT

|    |     |     |          |
|----|-----|-----|----------|
| a. | V06 | N01 | Flashing |
| b. | R1  |     | -00384   |
| c. | R2  |     | +00384   |
| d. | R3  |     | -00385   |

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6.2.20.2.32 Record CRT indications.

- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT  $-5.06 \pm 0.50$  V rms
- b. CG 2219 PITCH ATT ERROR - CDU DAC OUT  $+5.06 \pm 0.50$  V rms
- c. CG 2249 YAW ATT ERROR - CDU DAC OUT  $-5.06 \pm 0.50$  V rms

6.2.20.2.33 Insert in KI48

- a. VERB 33, ENTER

6.2.20.2.34 Observe on CRT.

- a. V06 N01 Flashing
- b. R1 -00385
- c. R2 +00385
- d. R3 +00000

6.2.20.2.35 Record CRT indications.

- a. CG 2279 ROLL ATT ERROR - CDU DAC OUT  $-5.06 \pm 0.50$  V rms
- b. CG 2219 PITCH ATT ERROR - CDU DAC OUT  $+5.06 \pm 0.50$  V rms
- c. CG 2249 YAW ATT ERROR - CDU DAC OUT  $0.00 \pm 0.06$  V rms

6.2.20.2.36 Insert in KI48.

- a. VERB 21 NOUN 01 ENTER
- b. 02545 ENTER
- c. 03362 ENTER
- d. VERB 33 ENTER

6.2.20.2.37 Observe on CRT.

- a. V06 N02 Flashing
- b. NO ATT ON
- c. R1 +00000 approximately
- d. R2 +00000 approximately
- e. R3 +00000 approximately

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- 6.2.20.3 TVC Test
- 6.2.20.3.1 The G/N Autopilot Control and SPS Ready discretes shall be applied to the G/N Interface.
- 6.2.20.3.2 Set the OPTICS MODE selector on the Indicator Control Panel to MAN. Set the OPTICS ZERO switch to OFF.
- 6.2.20.3.3 Insert in K148
- a. VERB 33, ENTER
- 6.2.20.3.4 Observe on CRT
- a. V 01 N10 Flashing  
b. R1 X7373  
c. R3 00030
- 6.2.20.3.5 Insert in K148
- a. V33 ENTR
- 6.2.20.3.6 Observe on CRT
- a. V 01 Noun 10 Flashing  
b. R1 37777  
c. R3 00031
- 6.2.20.3.7 Insert in K148
- a. V33 ENTER
- 6.2.20.3.8 Observe on CRT
- a. V06 N02 Flashing  
b. R1 +00385  
c. R2 -00385  
d. R3 +00003
- 6.2.20.3.9 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +10.12±1.00V rms  
b. CG 3721 SHAFT CDU DAC OUTPUT -10.12±1.00V rms
- 6.2.20.3.10 Insert in K148
- a. VERB 33, ENTER

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6.2.20.3.11 Observe on CRT

- a. V06 N 02 Flashing
- b. R1 +00384
- c. R2 -00384
- d. R3 +00003
- e. NO ATT OFF

6.2.20.3.12 Record CRT indications

- a. CG 3722 TRUNNION CDU DAC OUTPUT +10.12±1.00V rms
- b. CG 3721 SHAFT CDU DAC OUTPUT -10.12±1.00V rms

6.2.20.3.13 Insert in K148

- a. VERB 33, ENTER

6.2.20.3.14 Observe on CRT

- a. V06 N 02 Flashing
- b. R1 +00160
- c. R2 -00160
- d. R3 +00003

6.2.20.3.15 Record CRT indications

- a. CG 3722 TRUNNION CDU DAC OUTPUT +4.22±0.42V rms
- b. CG 3721 SHAFT CDU DAC OUTPUT -4.22±0.42V rms

6.2.20.3.16 Insert in K148

- a. VERB 33 ENTER

6.2.20.3.17 Observe on CRT

- a. V06 N 02 Flashing
- b. R1 +00135
- c. R2 -00135
- d. R3 +00003

6.2.20.3.18 Record CRT indications

- a. CG 3722 TRUNNION CDU DAC OUTPUT +3.56±0.36V rms
- b. CG 3721 SHAFT CDU DAC OUTPUT -3.56±0.36V rms

6.2.20.3.19 Insert in K148

- a. VERB 33 ENTER



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- 6.2.20.3.20 Observe on CRT
- a. V06 N02 Flashing
  - b. R1 +00090
  - c. R2 -00090
  - d. R3 +00003
- 6.2.20.3.21 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT +2.38±0.24V rms
  - b. CG 3721 SHAFT CDU DAC OUTPUT -2.38±0.24V rms
- 6.2.20.3.22 Set the OPTICS SPEED switch on the Indicator Control panel to HI.
- 6.2.20.3.23 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.24 Observe on CRT
- a. V06 N 02 Flashing
  - b. R1 +00000
  - c. R2 +00000
  - d. R3 +00003
- 6.2.20.3.25 While holding the Optics Hand Controller up and left (45°) no longer than 10 seconds, record CRT indications.
- a. CG 3722 TRUNNION CDU DAC OUTPUT 0.00±0.12V rms
  - b. CG 3721 SHAFT CDU DAC OUTPUT 0.00±0.12V rms
- 6.2.20.3.26 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.27 Observe on CRT
- a. V06 N 02 Flashing
  - b. R1 -00090
  - d. R2 +00090
  - d. R3 +00003
- 6.2.20.3.28 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -2.38±0.24V rms
  - b. CG 3721 SHAFT CDU DAC OUTPUT +2.38±0.24V rms

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- 6.2.20.3.29 Set the OPTICS ZERO switch and the Indicator Control panel to ZERO for 30 seconds then return to OFF.
- 6.2.20.3.30 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.31 Observe on CRT
- a. V06 N 02 Flashing  
b. R1 -00135  
c. R2 +00135  
d. R3 +00003
- 6.2.20.3.32 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -3.56±0.36V rms  
b. CG 3721 SHAFT CDU DAC OUTPUT +3.56±0.36V rms
- 6.2.20.3.33 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.34 Observe on CRT
- a. V06 N 02 Flashing  
b. R1 -00160  
c. R2 +00160  
d. R3 +00003
- 6.2.20.3.35 Record CRT indications
- a. CG 3722 TRUNNION CDU DAC OUTPUT -4.22±0.42V rms  
b. CG 3721 SHAFT CDU DAC OUTPUT +4.22±0.42V rms
- 6.2.20.3.36 Insert in K148
- a. VERB 33 ENTER
- 6.2.20.3.37 Observe on CRT
- a. V06 N 02 Flashing  
b. R1 -00384  
c. R2 +00384  
d. R3 +00003

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6.2.20.3.38 Record CRT indications

- a. CG 3722 TRUNNION CDU DAC OUTPUT -10.12±1.00V rms
- b. CG 3721 SHAFT CDU DAC OUTPUT +10.12±1.00V rms

6.2.29.3.39 Insert in KI48

- a. VERB 33 ENTER

6.2.20.3.40 Observe on CRT

- a. V06 N 02 Flashing
- b. R1 -00385
- c. R2 +00385
- d. R3 +00003

6.2.20.3.41 Record CRT indications

- a. CG 3722 TRUNNION CDU DAC OUTPUT -10.12±1.00V rms
- b. CG 3721 SHAFT CDU DAC OUTPUT +10.12±1.00V rms

6.2.20.3.42 Insert in KI48

- a. V 34 ENTER
- b. V 41 N 20 ENTER
- c. V 41 N 20 ENTER
- d. +00000 ENTER
- e. +00000 ENTER
- f. +00000 ENTER

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APPENDIX I

| Signal  | Link | Nomenclature                    | G&N Test Requirement                         | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|---------------------------------|----------------------------------------------|----------------------------------------------|
| CG 1020 | 1    | +14 VDC CMC SUPPLY              | +14.0±0.4 VDC                                | 0%                                           |
| CG 1021 | 1    | +14V CMC SUPPLY NOISE RMS       | 0.2 VRMS MAX                                 | 0%                                           |
| CG 1030 | 1    | +4 VDC CMC SUPPLY               | +4.00±0.2 VDC                                | 0%                                           |
| CG 1031 | 1    | +4V CMC SUPPLY NOISE RMS        | 0.2 VRMS MAX                                 | 0%                                           |
| CG 1040 | 2    | +120 VDC PIPA SUPPLY            | +120±6.0 VDC                                 | 1%                                           |
| CG 1042 | 1    | +120 VDC PIPA SUP NOISE RMS     | 1.5 VRMS MAX                                 | 0%                                           |
| CG 1051 | 1    | +20 VDC PIPA SUPPLY             | +20.0±1.2 VDC                                | 0%                                           |
| CG 1052 | 1    | -20 VDC PIPA SUPPLY             | -20±2 VDC                                    | 0%                                           |
| CG 1053 | 1    | +20 VDC PIPA SUP NOISE RMS      | 1.0 VRMS MAX                                 | 0%                                           |
| CG 1070 | 1    | +4 VDC CDU SUPPLY               | +4.0±0.2 VDC                                 | 0%                                           |
| CG 1071 | 1    | +4 VDC CDU SUP NOISE RMS        | 0.1 VRMS MAX                                 | 0%                                           |
| CG 1100 | 1    | +28 VDC SUPPLY                  | -27.5±6.0 VDC                                | 0%                                           |
| CG 1110 | 2    | 2.5 VDC TM BIAS                 | +2.50±0.06 VDC                               | 0%                                           |
| CG 1201 | 2    | IMU 28V .8KC 1% 0° RMS          | 28.00±0.56VRMS                               | 1%                                           |
| CG 1202 | 1    | IMU 28V .8KC 5% - 90° RMS       | 28.0±1.4VRMS                                 | 0.33%                                        |
| CG 1203 | 1    | IMU 28V .8KC 0° RMS             | 28.0±2.1 VRMS                                | 0.33%                                        |
| CG 1207 | 1    | PH DIFF IMU 5% 0°, -90°         | -90±10°                                      | 2.3%                                         |
| CG 1211 | 1    | OPTX 28V .8KC 1% 0° RMS         | 28.00±0.56 VRMS                              | 0.33%                                        |
| CG 1211 | 2    | OPTX 28V .8KC 1% 0° RMS         | 28.00±0.56 VRMS                              | 1%                                           |
| CG 1212 | 1    | OPTX 28V .8KC 5% - 90° RMS      | 28.00±1.48 VRMS                              | 0.33%                                        |
| CG 1220 | 1    | PH DIFF OPTX 1% IMU 1%          | 0° ±10                                       | 2.3%                                         |
| CG 1331 | 2    | 3.2 KC 28V SUPPLY               | 28.6±0.56 VRMS                               | 1%                                           |
| CG 1336 | 1    | PH DIFF 3.2 KC 28V/CMC SYNC     | 0° ±10°                                      | 2.3%                                         |
| CG 1500 | 1    | +28 VDC IMU OPERATE BUS         | 28.8±3 VDC                                   | 0%                                           |
| CG 1501 | 1    | +28V IMU OPERATE BUS NOISE RMS  | 1.0 VRMS MAX                                 | 0%                                           |
| CG 1510 | 1    | +28 VDC IMU STANDBY BUS         | 28.8±3 VDC                                   | 0%                                           |
| CG 1511 | 1    | +28V IMU STANDBY BUS NOISE RMS  | 1.0 VRMS MAX                                 | 0%                                           |
| CG 1520 | 1    | +28 VDC CMC OPERATE BUS         | 28.8±3 VDC                                   | 0%                                           |
| CG 1521 | 1    | +28V CMC OPERATE BUS NOISE RMS  | 2.0 VRMS MAX                                 | 0%                                           |
| CG 1530 | 1    | +28 VDC OPTX OPERATE BUS        | 28.8±3 VDC                                   | 0%                                           |
| CG 1531 | 1    | +28V OPTX OPERATE BUS NOISE RMS | 2.0 VRMS MAX                                 | 0%                                           |
| CG 2001 | 2    | X PIPA SG O/P                   | 5 VRMS max                                   | 3%                                           |
| CG 2021 | 2    | Y PIPA SG O/P                   | 5 VRMS max                                   | 3%                                           |
| CG 2041 | 2    | Z PIPA SG O/P                   | 5 VRMS max                                   | 3%                                           |
| CG 2108 | 1    | IG SERVO ERROR QUAD             | 0.0±1.2 VRMS                                 | 3.6%                                         |
| CG 2112 | 2    | IG 1X RESOLVER O/P SIN          | 18.38±1.84 VRMS @ 45°                        | 2.5%                                         |
| CG 2113 | 2    | IG 1X RESOLVER O/P COS          | 18.38±1.84 VRMS @ 45°                        | 2.5%                                         |
| CG 2117 | 2    | IG SERVO ERROR IN PHASE         | 0.0±60 mv RMS @ null                         | 1.4%                                         |
| CG 2120 | 1    | IG TORQUE MOTOR CURRENT         | 0.125 amp max during Fine Alignment Torquing | 0%                                           |

APPENDIX I (Continued)

| Signal  | Link | Nomenclature                   | G&N Test Requirement                     | PSAAM and/or SCA Uncertainty % of Full Scale |
|---------|------|--------------------------------|------------------------------------------|----------------------------------------------|
| CG 2138 | 1    | MG SERVO ERROR QUAD            | 0.0±1.2 VRMS                             | 3.6%                                         |
| CG 2142 | 2    | MG 1X RESOLVER O/P SIN         | 18.38±1.84 VRMS @ 45°                    | 2.5%                                         |
| CG 2143 | 2    | MG 1X RESOLVER O/P COS         | 18.38±1.84 VRMS @ 45°                    | 2.5%                                         |
| CG 2147 | 2    | MG SERVO ERROR IN PHASE        | 0.0±60 mv rms @ null                     | 1.4%                                         |
| CG 2150 | 1    | MG TORQUE MOTOR CURRENT        | 0.125 amp max during Fine Align Torquing | 0%                                           |
| CG 2168 | 1    | OG SERVO ERROR QUAD            | 0.0±1.2 VRMS                             | 3.6%                                         |
| CG 2172 | 2    | OG 1X RESOLVER O/P SIN         | 18.38±1.84 VRMS @ 45°                    | 2.5%                                         |
| CG 2173 | 2    | OG 1X RESOLVER O/P COS         | 18.38±1.84 VRMS @ 45°                    | 2.5%                                         |
| CG 2177 | 2    | OG SERVO ERROR IN PHASE        | 0.0±60 mv RMS @ null                     | 1.4%                                         |
| CG 2180 | 1    | OG TORQUE MOTOR CURRENT        | 0.125 amp max during Fine Align Torquing | 0%                                           |
| CG 2219 | 1    | PITCH ATT ERROR-CDU DAC O/P    | 5.06±0.5 VRMS @ 17°                      | 0.67%                                        |
| CG 2219 | 2    | PITCH ATT ERROR-CDU DAC O/P    | 5.06±5 VRMS @ null                       | 1%                                           |
| CG 2220 | 1    | IG CDU FINE ERROR              | 0.0±0.07 VRMS @ null                     | 0.29%                                        |
| CG 2221 | 1    | IG CDU COARSE ERROR            | 0.0±0.68 VRMS at null                    | 0.29%                                        |
| CG 2249 | 1    | YAW ATT ERROR-CDU DAC O/P      | 5.06±0.5 VRMS at 17°                     | 0.67%                                        |
| CG 2249 | 2    | YAW ATT ERROR-CDU DAC O/P      | 5.06±0.5 VRMS @ null                     | 1%                                           |
| CG 2250 | 1    | MG CDU FINE ERROR              | 0.0±0.07 VRMS at null                    | 0.29%                                        |
| CG 2251 | 1    | MG CDU COARSE ERROR            | 0.0±0.68 VRMS at null                    | 0.29%                                        |
| CG 2279 | 1    | ROLL ATT ERROR-CDU DAC O/P     | 5.06±0.5 VRMS at 17°                     | 0.67%                                        |
| CG 2279 | 2    | ROLL ATT ERROR-CDU DAC O/P     | 5.06±0.5 VRMS @ null                     | 1%                                           |
| CG 2280 | 1    | OG CDU FINE ERROR              | 0.0±0.07 VRMS at null                    | 0.29%                                        |
| CG 2281 | 1    | OG CDU COARSE ERROR            | 0.0±0.68 VRMS                            | 0.29%                                        |
| CG 2300 | 2    | PIPA TEMPERATURE               | 130.5±1.5° F Operate Mode                | 2%                                           |
| CG 2301 | 1    | IRIG TEMPERATURE               | 135±2.5° F in Operate                    | 2%                                           |
| CG 2301 | 2    | IRIG TEMPERATURE               | 135±2.5° F in Operate                    | 1%                                           |
| CG 3011 | 1    | TRUNNION CDU FINE ERROR        | 0.0±0.07 VRMS at null                    | 0.29%                                        |
| CG 3011 | 2    | TRUNNION CDU FINE ERROR        | 0.0±0.07 VRMS @ null                     | 1%                                           |
| CG 3021 | 1    | SHAFT CDU FINE ERROR           | 0.0±0.07 VRMS at null                    | 0.29%                                        |
| CG 3021 | 2    | SHAFT CDU FINE ERROR           | 0.0±0.07 VRMS @ null                     | 1%                                           |
| CG 3117 | 1    | SXT SHAFT SERVO ERROR IN PH    | -0.25 to -2.00 VRMS at Hi Rate           | 1.1%                                         |
| CG 3118 | 1    | SXT TRUNNION SERVO ERROR IN PH | -0.25 to -2.00 VRMS at Hi Rate           | 1.1%                                         |
| CG 3140 | 1    | SXT SHAFT TACH O/P             | 3.3±1.3 VRMS at Hi Rate                  | 1.1%                                         |
| CG 3140 | 2    | SXT SHAFT TACH O/P             | 3.3±1.3 VRMS @ Hi Rate                   | 2%                                           |
| CG 3145 | 1    | SXT SHAFT MTR CONTROL WINDING  | +0.5 to 4.00 VRMS at Med Rate            | 1.1%                                         |
| CG 3150 | 1    | SXT TRUNNION TACH O/P          | 3.3±1.3 VRMS at Hi Rate                  | 1.1%                                         |
| CG 3150 | 2    | SXT TRUNNION TACH O/P          | 3.3±1.3 VRMS @ Hi Rate                   | 2%                                           |

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APPENDIX I (Continued)

| <u>Signal</u> | <u>Link</u> | <u>Nomenclature</u>              | <u>G&amp;N Test Requirement</u> | <u>PSAAM and/or SCA Uncertainty % of Full Scale</u> |
|---------------|-------------|----------------------------------|---------------------------------|-----------------------------------------------------|
| CG 3155       | 1           | SXT TRUNNION MTR CONTROL WINDING | +0.25 to +2.00 VRMS at Med Rate | 1.1%                                                |
| CG 3160       | 1           | SCT SHAFT TACH O/P               | 3.3±1.3 VRMS at Hi Rate         | 1.1%                                                |
| CG 3160       | 2           | SCT SHAFT TACH O/P               | 3.3±1.3 VRMS at Hi Rate         | 2%                                                  |
| GC 3170       | 1           | SCT TRUNNION TACH O/P            | 0.85±0.35 VRMS at Hi Rate       | 1.1%                                                |
| CG 3170       | 2           | SCT TRUNNION TACH O/P            | 0.85±0.35 VRMS at Hi Rate       | 2%                                                  |
| CG 3721       | 2           | SHAFT CDU DAC O/P                | 10.12±1.00 VRMS at 17°          | 1%                                                  |
| CG 3722       | 2           | TRUNNION CDU DAC O/P             | 10.12±1.00 VRMS at 17°          | 1%                                                  |
| CG 4300       | 1           | CMC TEMP                         | 87.5±42.5° F                    | 0.23%                                               |
| CG 6020       | 1           | PIPA CAL MODULE TEMP             | 72.5±27.5° F                    | 0.23%                                               |
| CG 6021       | 1           | IMU 800 cps 5% TEMP (PSA)        | 90±30° F                        | 0%                                                  |

PSAAM OUTPUT is the source of Link 1 signals. SCA OUTPUT is the source of Link 2 signals.

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ADDENDUM I - Deleted

ADDENDUM II - Deleted

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ADDENDUM III Deleted



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ADDENDUM IV Deleted

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POST INSTALLATION CHECKOUT PROCESS  
 SPECIFICATION FOR THE APOLLO GUIDANCE &  
 NAVIGATION SYSTEM BLOCK II-KSC

Record of Revisions

| Date     | Revision Letter | TDRR No. | Pages Revised                                           | Approvals |      |
|----------|-----------------|----------|---------------------------------------------------------|-----------|------|
|          |                 |          |                                                         | DE        | NASA |
| 4/2/70   | N               | 38089    | 17-19, 151, 152 <i>FAI/AC</i>                           | EA        | MDH  |
| 11/23/70 | P               | 38294    | 8, 17-152. Was 152 pages; now 139 pages. <i>RFB/AC</i>  | EA        | MDH  |
| 2/8/71   | R               | 38347    | 28, 36-139. Was 139 pages; now 142 pages. <i>RFB/AC</i> | JS        | MDH  |
|          |                 |          |                                                         |           |      |
|          |                 |          |                                                         |           |      |
|          |                 |          |                                                         |           |      |
|          |                 |          |                                                         |           |      |
|          |                 |          |                                                         |           |      |
|          |                 |          |                                                         |           |      |

This specification consists of page 1 to 142 inclusive.

|           |          |                          |                                |                                    |
|-----------|----------|--------------------------|--------------------------------|------------------------------------|
| APPROVALS | NASA/MSC | W. S. Swingle<br>2/17/67 | E. Austin<br>2/17/67<br>MIT/IL | R. D. Petryk<br>D. A. Ziemer<br>DE |
|           |          |                          |                                |                                    |

6.2.3.1.11 Verify that the following secondary power supply voltages are not flashing on the CRT display.

SECONDARY POWER SUPPLY VOLTAGES

| <u>Meas. No.</u> | <u>Signal</u>              |
|------------------|----------------------------|
| 1. CG 1040       | +120 VDC PIPA SUPPLY       |
| 2. CG 1051       | +20 VDC PIPA SUPPLY        |
| 3. CG 1052       | -20 VDC PIPA SUPPLY        |
| 4. CG 1070       | +4 VDC CDU SUPPLY          |
| 5. CG 1190       | -28 VDC ELECTRONICS        |
| 6. CG 1020       | +14 VDC CMC SUPPLY         |
| 7. CG 1030       | +4 VDC CMC SUPPLY          |
| 8. CG 1201       | IMU 28V 800 CPS 1 pct 0 ph |
| 9. CG 1202       | IMU 28V 800 CPS 5 pct ph A |
| 10. CG 1203      | IMU 28V 800 CPS 5 pct ph B |
| 11. CG 1331      | 3.2KC 28V SUPPLY           |
| 12. CG 1110      | 2.5 VDC TM BIAS            |

6.2.3.1.12 The IMU Platform should not be moved during the Temperature Control Test, 15 minutes after the application of IMU OPERATE power record PIPA TEMP (CG 2300) displayed on the CRT.

6.2.3.1.14 1 hour after the application of IMU OPERATE power monitor and record PIPA TEMP (CG 2300) every 5 minutes for 1 hour. Verify that each reading does not deviate from the average of each signal by more than 0.1°F.

6.2.3.1.15 When 2 hours have elapsed since the application of IMU OPERATE power record PIPA TEMP, PIPA TEMP shall be 130.5±1.5°F. PIPA TEMP shall be within 0.5°F of that recorded in 6.2.3.1.12 and 6.2.1.3.8.4.

6.2.3.1.16 IMU Heater Current Duty Cycle Determination

NOTE: This test is to be performed once in the MSO and at the PAD during FRT and CDDT.

6.2.3.1.16.1 The following initial conditions must be met before continuing:

- (1) The G&N System shall have been in the Operate Mode at least 1.5 hours with the IMU gimbals coarse aligned to zero degrees.
- (2) The IMU coolant flow rate and coolant temperature shall have been constant for at least one hour prior to taking data.
- (3) The 28 VDC IMU STANDBY BUS (CG 1510) shall be held constant within ±0.25 VDC for one hour prior to taking data.

6.2.3.1.16.2 Record and identify the following signals as indicated:

| Signal No. | Signal Name                  | I. D.           |
|------------|------------------------------|-----------------|
| a. CG 1510 | 28 VDC IMU STANDBY           | E <sub>B+</sub> |
| b. CG 1202 | IMU 28V 800 CPS, Phase A     | E <sub>A</sub>  |
| c. CG 1203 | IMU 28V 800 CPS, Phase B     | E <sub>B</sub>  |
| d. CF 0157 | CM Vehicle Coolant Flow Rate | R               |
| e. CF 0018 | Coolant Temperature          | T               |

6.2.3.1.16.3 Perform the following calculation and identify the result as E<sub>AB</sub>

$$\frac{E_A + E_B}{2} = E_{AB}$$

6.2.3.1.16.4 Calculate the Duty Cycle for the IMU HEATER CURRENT (CG 2302) by dividing the time ON for 10 cycles by the total (ON and OFF) time for 10 cycles as indicated on the event recorder. Identify this result as DC<sub>ACT</sub>.

6.2.3.1.16.5 Normalize the calculated Duty Cycle (DC<sub>ACT</sub>) for power input as follows:

$$DC_{S/C} = DC_{ACT} [0.071 (E_{B+} + E_{AB}) - 2.976]$$

6.2.3.1.16.6 Determine the estimated Duty Cycle by going to the coordinates R and T (Figure 3). Identify the results as DC<sub>G</sub>.

6.2.3.1.16.7 From the Acceptance Data Package (ADP) obtain and identify the following most current information

| Source       | Data                    | I. D.                  |
|--------------|-------------------------|------------------------|
| a. JDC 14033 | IMU Heater Duty Cycle   | DC <sub>ACT(ISS)</sub> |
| b. JDC 14033 | DC Bus (AGE Voltage)    | E <sub>B+(ISS)</sub>   |
| c. JDC 14039 | IMU 28V 800 CPS Phase A | E <sub>A(ISS)</sub>    |
| d. JDC 14039 | IMU 28V 800 CPS Phase B | E <sub>B(ISS)</sub>    |

6.2.3.1.16.8 Perform the following calculation and identify the result as E<sub>AB(ISS)</sub>

$$\frac{E_{A(ISS)} + E_{B(ISS)}}{2} = E_{AB(ISS)}$$

6.2.3.1.16.9 Normalize the calculated duty cycle DC<sub>ACT(ISS)</sub> as follows:

$$DC_{ISS} = DC_{ACT(ISS)} [0.071 (E_{B+(ISS)} + E_{AB(ISS)}) - 2.976]$$

APOLLO G&N Specification  
 WD 1002349 REV A  
 Original Issue Date:  
 Release Authority: TDRR 32362  
 Class A Release

POST INSTALLATION CHECKOUT  
 SPECIFICATION FOR LEM G&N  
 SYSTEM (MBC)

Record of Revisions

| (A) Date | Revision Letter | TDRR No. | Pages Revised                                       | Approval |
|----------|-----------------|----------|-----------------------------------------------------|----------|
| 3/31/67  | A               | 33482    | 2, 3, 5-75; was 75 pages, now 83 pages. <i>done</i> | MGM EA   |
|          |                 |          |                                                     |          |
|          |                 |          |                                                     |          |
|          |                 |          |                                                     |          |
|          |                 |          |                                                     |          |
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|          |                 |          |                                                     |          |
|          |                 |          |                                                     |          |

This specification consists of page 1 to 83 inclusive.

|           |                                        |                                  |                            |
|-----------|----------------------------------------|----------------------------------|----------------------------|
| APPROVALS | NOT REQUIRED<br>CA497-0274<br>NASA/MSC | <i>27/1/66</i><br><i>12/2/66</i> | <i>[Signature]</i><br>ACED |
|-----------|----------------------------------------|----------------------------------|----------------------------|

1. INTRODUCTION

- 1.1 The individual Spacecraft (SC) installed Guidance and Navigation (G&N) System to be checked out per the process specification shall consist of one of each of the following major assemblies. Refer to drawing 6015000 for specific system dash numbers and effectivities.

| <u>Assembly Name</u>                            | <u>Part Number</u> |
|-------------------------------------------------|--------------------|
| 1 - Apollo Guidance Computer Group              | 6003001-XXX        |
| 1 - Inertial Meas. Unit & Pulse Torque Assembly | 6007001-XXX        |
| 1 - Coupling Data Unit                          | 2007222-XXX        |
| 1 - Power and Servo Assembly                    | 6007200-XXX        |
| 1 - Computer Control & Reticle Dimmer Assembly  | 6014512-XXX        |
| 1 - G&N Interconnect Harness Assembly (LEM)     | 6014515-XXX        |
| 1 - Signal Conditioner Assembly                 | 6070010-XXX        |
| 1 - Navigation Base Assembly (LEM)              | 6899950-XXX        |
| 1 - Alignment Optical Telescope (LEM)           | 6011000-XXX        |

- 1.2 The G&N System herein shall be identified by Part #6015000. The computer contains the BURST 113 program flight ropes in the core rope memory.

2. SCOPE

- 2.1 This specification outlines the checkout requirements for G&N System installed in a LEM Vehicle. Addendum to this specification will cover any special checkout requirements associated with individual vehicles, G&N Systems and Computer Flight Programs.

3. APPLICABLE DOCUMENTS

| <u>Document Number</u> | <u>Subject</u>                                 |
|------------------------|------------------------------------------------|
| LIS-540-10001          | LEM-FGNS Functional Interface                  |
| LID-340-10000          | ICD-FGNS (LGC-CDU-PSA and Sig. Cond.) Instl.   |
| LID-340-10010          | ICD-LEM DSKY Installation                      |
| LID-280-10004          | ICD-IMU-ACT-NVB-PTA Installation               |
| LID-390-10001          | ICD-LEM Wiring Electrical Interface for FGNS   |
| LID-540-10001          | ICD-LEM-FGNS Functional Interface Flow Diagram |

| <u>Document Number</u>  | <u>Subject</u>                                                                                                   |
|-------------------------|------------------------------------------------------------------------------------------------------------------|
| LIS-510-10001           | Thermodynamic Requirements of Guidance & Navigation Equipment - GANE                                             |
| LIS-520-10001           | LEM Design Environment                                                                                           |
| LIS-350-10002           | LEM-PGNS Lateral and Forward Velocity Interface                                                                  |
| LIS-370-10007           | LEM-PGNS 800 CPS Power Electrical Interface                                                                      |
| LIS-370-10003           | LEM-PGNS Measurement Interface                                                                                   |
| LIS-370-10004           | LEM-LGC Electrical Interface                                                                                     |
| LIS-390-10002           | Guidance and Navigation Prime Power Requirements and Characteristics                                             |
| LID-410-10002           | ICTC System Interface                                                                                            |
| LID-410-10003           | PSA Adapter Module Interface                                                                                     |
| PS6015000               | Master End Item Specification, Product Configuration and Acceptance Test Requirements, PGNS Spacecraft Equipment |
| 3.2.1 Addendum 1 LEM 1. |                                                                                                                  |

3.2 The following addendum are applicable to this document.

3.2.1 Addendum 1 LEM 1.

| ITEM    | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                | MODEL NO. |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 30      | 5 Place Sine-Cosine Tables, Friden Calculator                                                                                                                                                                                                                                                                                                                                                              |           |
| 31      | Dioptrimeter                                                                                                                                                                                                                                                                                                                                                                                               |           |
| 5.      | GENERAL REQUIREMENTS                                                                                                                                                                                                                                                                                                                                                                                       |           |
| 5.1     | Safety Requirements                                                                                                                                                                                                                                                                                                                                                                                        |           |
| 5.1.1   | Operator Safety                                                                                                                                                                                                                                                                                                                                                                                            |           |
| 5.1.1.1 | Normal safety precautions shall be observed through the G&N post-installation checkout.                                                                                                                                                                                                                                                                                                                    |           |
| 5.1.2   | Equipment Safety                                                                                                                                                                                                                                                                                                                                                                                           |           |
| 5.1.2.1 | To preserve the operational life of the components of the G&N hardware under test, settings and adjustments shall be performed only when specified in the test procedure. Care shall be exercised in the accomplishment of all settings and adjustments to avoid excessive wear or damage to the equipment. All precautionary measures stated throughout the test procedures shall be strictly adhered to. |           |
| 5.1.2.2 | The connection between the Portable Temperature Controller (PTC) and 56J1 shall be maintained unless otherwise specified.                                                                                                                                                                                                                                                                                  |           |
| 5.1.2.3 | The temperature of the inertial components shall be maintained between the following limits. If these limits are exceeded, the inertial components shall be recalibrated.<br><br>a. IRIG: 120 Deg F and 150 Deg F<br>b. PIP: 115 Deg F and 145 Deg F                                                                                                                                                       |           |
| 5.1.2.4 | All personnel concerned shall thoroughly understand the Operational Requirements in Section 6.2 to preclude any damage to the G&N System.                                                                                                                                                                                                                                                                  |           |
| 5.1.2.5 | To preserve the operational life of the components of the DSKY, the monitor routines shall be used only when required by test procedure or trouble shooting. Such routines shall be terminated as quickly as possible in the test flow. Computer routines which cause the DSKY display to flash (either requesting data or displaying data) shall also be terminated as quickly as possible.               |           |
| 5.2     | Coolant Requirements                                                                                                                                                                                                                                                                                                                                                                                       |           |
| 5.2.1   | When electrical power is applied to the G&N System, the IMU shall be provided with water-glycol coolant at a temperature of 32-50 deg F and a flow rate of 33±5 pounds per hour.                                                                                                                                                                                                                           |           |



- 5.2.2 The PSA, CDU, and PTA cold plates shall be provided with coolant as per ICD LIS-510-10001.
- 5.3 Test Equipment Tolerances
- 5.3.1 Measurements and tolerances specifications stated herein are basic G&N System performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. Final tolerances must include PSAAM and Signal Conditioner stability uncertainties (See Appendix 1) as well as ACE and ACE carry-on conditioning uncertainties. All uncertainties due to instrumentation shall be root sum squared with the basic G&N subsystem tolerance to yield an acceptable tolerance for use when testing the G&N system in the spacecraft.
- 5.3.2 In the event of a conflict between requirements, the following order of procedure shall apply. The contractor shall also notify AC Electronics Site Manager of the conflict.
- The contract
  - The Specification
  - Documents referenced in this specification.
- 5.4 Test Sequence
- 5.4.1 The test sequence shall normally follow the flow gram in Figure 1. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.
- 5.5 The generation of noise alarm indication, as evidenced by one or more Noise Peak Event Lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.
- 5.6 Test Failure Criteria
- 5.6.1 IRIG and PIPA data (See paragraph 6.3.9)
- 5.6.1.1 If  $D_1$ ,  $D_2$ , or  $D_3$  exceeds its maximum value for any PIPA or IRIG, that PIPA or IRIG shall be retested in the following sequence.



If  $D_1$ ,  $D_2$ , and  $D_3$  are within tolerance after the retest sequence is completed, the original out-of-tolerance terms calculated in paragraph 6.3.9.70.4 shall be exonerated.

- 5.6.1.2 Failure to be within the maximum values of  $D_1$ ,  $D_2$ , and  $D_3$  after the retest sequence of 5.6.1.1 shall constitute a failure of the assembly.
- 5.6.2 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N system as non-conforming. Normal test sequence may be continued upon determination of the cause of the nonconformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All nonconformances shall be investigated and cleared by waivers (F.N.N), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory where the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.
- 5.7 Retest subsequent to replacement of a failed assembly by a flight certified assembly shall be at the discretion of NASA. It is suggested that Table I Retest guide be used in determining which tests or applicable portions thereof shall constitute adequate retest. Retest procedures shall be performed in accordance with the Test Procedure Flowgram, Figure 2.
- 5.8 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.
- 5.9 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N is being conducted.
- 5.10 Data Retrieval
  - 5.10.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance readings shall be recorded and flagged by appropriate signals.
  - 5.10.2 During G&N System testing, all interleaved data, Uplink Command File and Downlink Data File shall be maintained (recorders ON). All A/B PCM data, that is not made available to the ACE displays shall be verified by requesting a time history data strip out of said data for the time period when the test was performed.

| <u>Paragraph No.</u> | <u>Test Title</u>                       |
|----------------------|-----------------------------------------|
| 6.3.1                | Standby Power In Test                   |
| 6.3.2                | Alarms and Interrupts Test              |
| 6.3.3                | IMU Operate Power On Test               |
| 6.3.4                | Temperature Control Verification        |
| 6.3.5                | PGNCS Power Supply Test                 |
| 6.3.6                | IMU Operational Test                    |
| 6.3.7                | PGNCS Operational Test                  |
| 6.3.8                | IRIG Scale Factor Test                  |
| 6.3.9                | IMU Performance Test                    |
| 6.3.10               | LGC Voltage Margin Test                 |
| 6.3.11               | LGC Clock Frequency Test                |
| 6.3.12               | Gimbal Friction Test                    |
| 6.3.13               | Stabilization Loop Response Test        |
| 6.3.14               | G and N Fine Alignment Test             |
| 6.3.15               | AOT Functional Performance Test         |
| 6.3.16               | Flight Rope Fixed Memory Bank Sum Check |
| 6.3.17               | LGC Clock Alignment Test                |

#### TEST SEQUENCE

Figure 1

#### 6. DETAILED REQUIREMENTS

##### 6.1 Initial Test Conditions

6.1.1 The IMU shall be supplied with heater power on a continuous basis. The portable temperature controller (Model No. 410-31058) shall be connected at all times although heater power may be supplied from the +28 VDC IMU STANDBY bus and monitored through ACE.

6.1.2 The IMU shall never be without heater power longer than 15 minutes.

##### 6.2 Operational Requirements

NOTE: In the event that an Electrical Power Subsystem (EPS) shutdown occurs for any reason while the G&N System is in the Operate Mode, turn off the +28 VDC IMU OPERATE circuit breaker or LEM Cabin Panel 11. Do not turn the +28 VDC IMU OPERATE Circuit breaker on for a minimum of 5 minutes after the EPS shutdown occurs. Failure to observe this requirement can result in shifts of the critical Inertial Component parameters.

TABLE I RETEST SEQUENCE

| Paragraph Number | Test Title                       | LGC | IMU | PSA | CDU | PTA | DSKY | A HARNESS | B HARNESS | Computer Control | Reticle Illuminator | Nav Base | Alignment Optical Telescope | Signal Conditioner |
|------------------|----------------------------------|-----|-----|-----|-----|-----|------|-----------|-----------|------------------|---------------------|----------|-----------------------------|--------------------|
| 6.3.1            | Standby Power On Test            | X   | X   | X   |     |     | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.2            | Alarms and Interrupts Test       | X   |     |     |     |     | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.3            | IMU Operate Power On Test        |     | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.4            | Temperature Control Verification |     | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.5            | PGNCS Power Supply Test          |     | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.6            | IMU Operational Test             | X   | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.7            | PGNCS Operational Test           |     | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.8            | IRIG Scale Factor Test           |     | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.9            | IMU Performance Test             |     | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.10           | LGC Voltage Margin Test          | X   |     |     |     |     | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.11           | LGC Clock Frequency Test         | X   |     |     |     |     | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.12           | Gimbal Friction Test             |     | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.13           | Stabilization Loop Response Test |     | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.14           | G&N Fine Alignment Test          |     | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.15           | AOT Functional Performance Test  |     | X   | X   | X   | X   | X    | X         | X         |                  |                     |          |                             |                    |
| 6.3.16           | Flight Rope Fixed Memory Bank    |     |     |     |     |     |      |           |           |                  |                     |          |                             |                    |
|                  | Sum Check                        | X   |     |     |     |     | X    |           |           |                  |                     |          |                             |                    |
| 6.3.17           | LGC Clock Alignment Test         | X   |     |     |     |     | X    |           |           |                  |                     |          |                             |                    |
| 6.2.1            | Emergency Shutdown Procedure     | *   | *   | *   | *   | *   | *    | *         | *         | *                | *                   | *        | *                           | *                  |
| 6.2.2            | Normal Shutdown Procedure        | *   | *   | *   | *   | *   | *    | *         | *         | *                | *                   | *        | *                           | *                  |
| 6.2.3            | Initial Turn-On Procedure        | *   | *   | *   | *   | *   | *    | *         | *         | *                | *                   | *        | *                           | *                  |
| 6.2.4            | General Turn-On Procedure        | *   | *   | *   | *   | *   | *    | *         | *         | *                | *                   | *        | *                           | *                  |

\* To be used as necessary to turn system on or off.

6.2.4 General Turn-On Procedure

6.2.4.1 This step shall be effective only after having completed the initial turn-on procedures.

6.2.4.2 Proper coolant flow shall be verified.

6.2.4.3 Depress +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11 to supply IMU STANDBY power. Record time.

6.2.4.4 Depress +28 VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11 to supply LGC Operate Power.

6.2.4.5 Depress STBY pushbutton on DSKY for 3 seconds and verify STBY light on DSKY is off.

6.2.4.6 On K-148 enter the following sequence:

Press ERROR RESET

VERB 36 ENTR (fresh start)

VERB 57 ENTR

00015 ENTR

VERB 21 NOUN 27 ENTR

77777 ENTR (LGC Self Check)

6.2.4.7 On the CRT, verify that the 3.2KC 28V Supply indicates between 28.04 and 29.16 VRMS (GG 1331).

6.2.4.8 On the CRT DSKY display verify that R1 does not display 01102 or 41102 (indicating a malfunction).

6.2.4.9 After 5 minutes enter the following in K-148:

|            |         |                      |
|------------|---------|----------------------|
| a. VERB 25 | NOUN 01 | ENTR                 |
| b. 03770   |         | ENTR SET LOC         |
| c. 10067   |         | ENTR CCS NEW JOB     |
| d. 05532   |         | ENTR TC CHANG1       |
| e. 01770   |         | ENTR TC ACTLITON     |
| f. VERB 25 | NOUN 26 | ENTR CALL PRIO/DELAY |
| g. 01000   |         | ENTR 01 PRIORITY     |
| h. 01770   |         | ENTR RELATIVE E-MEM  |
| i. 00007   |         | ENTR BANKADD.        |
| j. VERB 30 |         | ENTR REQ EXEC.       |

NOTE: If a VERB 36 is performed after the above information has been entered repeat lines 6.2.4.9.f through 6.2.4.9.j.

6.2.4.10 **CAUTION:** LOC OPERATE and IMU STANDBY power must have been applied a minimum of two hours before energizing the IMU OPERATE circuit breaker in step 6.2.4.16 unless all of the following conditions are met:

- IF:
1. The G&N System has previously been in Standby Mode at least two hours and subsequently been in Operate Mode, AND
  2. The gimbals were placed in a parked position prior to shutdown, AND
  3. The shutdown period did not exceed 5 days, AND
  4. The Spacecraft or IMU have not been moved in any way during the shutdown period.

THEN: The two-hour Standby Mode operation requirement is reduced to 15 minutes.

6.2.4.11 The G&N System is defined as being in Standby Mode when LOC Operate and IMU Standby power is applied and IMU Operate power is off. The inertial components shall have suspension power in Standby Mode.

6.2.4.12 The G&N System is defined as being in Operate Mode when LOC OPERATE, IMU STANDBY and IMU OPERATE POWER is applied to the system.

6.2.4.13 Set up analog recorder to monitor the following signals:

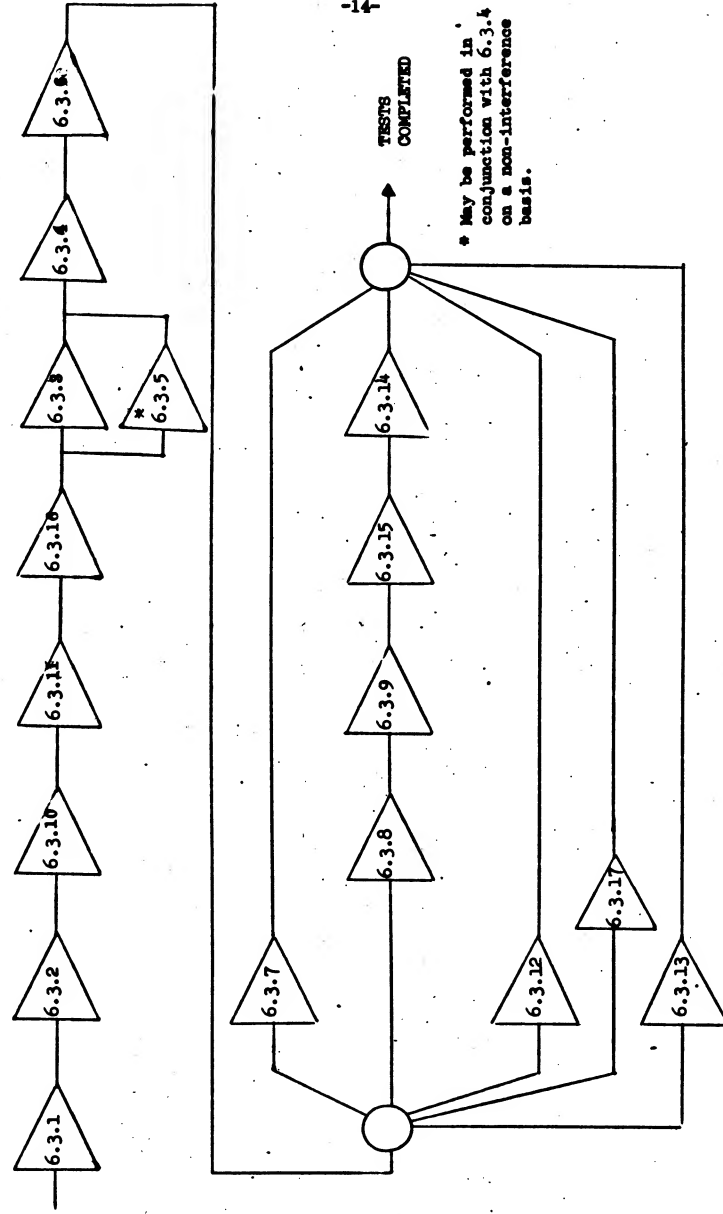
| Signal No. | Signal Name                     |
|------------|---------------------------------|
| a. OG 2136 | MG Servo Error Total            |
| b. OG 2106 | IG Servo Error Total            |
| c. OG 2166 | OG Servo Error Total            |
| d. OG 2112 | IG 1X Resolver Sine             |
| e. OG 2172 | OG 1X Resolver Sine             |
| f. OG 2142 | MG 1X Resolver Sine             |
| g. OG 1201 | IMU 28V 1 $\frac{1}{2}$ 800 CPS |

6.2.4.14 Start the analog recorder at a chart speed of 5 mm/sec. Start the event recorder at a chart speed of 1 mm/sec.

6.2.4.15 On CRT, monitor +120 VDC PIPA SUPPLY (OG 1040) and IMU Gimbal angles. Record time. If 15 minutes have elapsed since performing paragraph 6.2.4.3 proceed to the next paragraph.

6.2.4.16 Press in +28VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

- 6.2.4.17 Verify on the analog recorder that the oscillations of the resolver sine signals (GG 2112, GJ 2172, and GG 2142) are not sustained and that the signals damp out within 15 seconds. If this condition is not attained, remove IMU OPERATE power immediately.
- 6.2.4.18 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for  $90 \pm 10$  seconds after step 6.2.4.16 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.2.4.16.
- 6.2.4.19 Verify absence of LGC WARNING, ISS WARNING, and PGNC CAUTION lights in the LEM cabin.
- 6.2.4.20 On the CRT, verify all IMU Gimbal angles between 358 and 002.
- 6.2.4.21 On K-148 enter the following sequence:  
VERB 41        NOUN 20        ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.2.4.22 On the CRT, scan the power supply voltages to verify their normal operation. (No indications flashing).
- 6.2.4.23 After all the tests of 6.3 in Figure 1 have been completed, the General Turn-On Procedure (6.2.4) and IMU Operational Test (6.3.6) shall be completed before re-running any test. Otherwise, the testing sequence shall continue in accordance with Figure 2.
- 6.2.5 Interruption of Power.
- 6.2.5.1 IMU Operate power shall never be applied without the presence of LGC Operate and IMU Standby Power.
- 6.2.5.2 The G&N System log book shall include the gimbal positions at time of power shutdown. If omitted, it shall be assumed that the gimbals were not parked prior to shutdown. The logbook shall also state if any movement of the IMU or Spacecraft has taken place after shutdown. The times of application and removal of any bus power to the G&N System shall be recorded.
- 6.2.5.3 After the system has been operating with IMU Operate power on, and a power interruption occurs, a minimum of 15 minutes operation in Standby Mode is required before resuming IMU Operate power. If the power interruption was longer than 15 minutes, the G&N System shall be run in Standby Mode for a time interval at least equal to the duration power was off before resuming IMU Operate power. However, this period need not exceed two hours before application of IMU Operate power.



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TESTS COMPLETED

\* May be performed in conjunction with 6.3.4 on a non-interference basis.

\* May be performed in conjunction with 6.3.4 on a non-interference basis.

**TEST PROCEDURE FLOWGRAM**  
**FIGURE 2**



- 6.2.6 A warmup period of at least one hour in Operate Mode is required prior to performing any test in which gyro or accelerometer parameters are measured, and at least 15 minutes prior to any test in which precision amplitude and frequency power supply checks are made.

6.3 Test Procedures

6.3.1 Standby Power On Tests

- 6.3.1.1 The Portable Temperature Controller, Model No. 400-31058 shall be supplying inertial component heater power to the G&M System through connector 56J1 (P230). If alarm or fail indications are present on the PTC, they shall be cleared by depressing the SYSTEM RESET push-button on the PTC.

- 6.3.1.2 The following switches and/or circuit breakers shall be closed to energize the indicated buses.

| LOCATION | NOMENCLATURE             | IDENTIFICATION |
|----------|--------------------------|----------------|
| Panel 14 | BAT 5 NORMAL FEED        | 4S10           |
| Panel 14 | BAT 6 NORMAL FEED        | 4S11           |
| Panel 16 | X LUNAR BUS TIE          | 4CB5           |
| Panel 16 | BAT 1-4-6 FEED TIE       | 4CB17          |
| Panel 16 | BAT 2-3-5 FEED TIE       | 4CB25          |
| Panel 16 | ASC ECA                  | 4CB14          |
| Panel 16 | ASC ECA CONT.            | 5CB7           |
| Panel 16 | DC BUS VOLT              | 4CB21          |
| Panel 16 | DISP.                    | 4CB16          |
| Panel 11 | X LUNAR BUS TIE          | 4CB4           |
| Panel 11 | BAT 1-4-6 FEED TIE       | 4CB18          |
| Panel 11 | BAT 2-3-5 FEED TIE       | 4CB26          |
| Panel 11 | ASC ECA                  | 4CB15          |
| Panel 11 | ASC ECA CONT.            | 4CB6           |
| Panel 11 | DC BUS VOLT              | 4CB22          |
| Panel 16 | INV. NO. 2               | 4CB13          |
| Panel 14 | AC FWR to INV 2 Position | 4S14           |
| Panel 11 | AC BUS FEED TIE          | 4CB24          |
| Panel 11 | AC BUS VOLT              | 4CB27          |

6.3.1.3 IMU Standby Power Turn On

- 6.3.1.3.1 Turn on Event Recorder to a speed of 10 mm/sec. (10/100 mm/sec).
- 6.3.1.3.2 Press in +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11. Record time.
- 6.3.1.3.3 Verify on the Event Recorder that +28 VDC IMU STANDBY power discrete (00 1513) is on. On CRT +28V IMU STANDBY Bus (00 1510) shall indicate between 24.5 and 33.5

- 6.3.1.3.4 On CRT the 28V 3200 CPS SUPPLY (GG 1331) shall indicate between 28.04 and 29.16 VRMS. Record this value.
- 6.3.1.3.5 The PIPA TEMP, displayed on CRT, shall be monitored periodically one hour to ensure that the PIPA Temperature Control circuitry is operating to maintain a temperature of  $130 \pm 5.0$  Deg. F. (GG 2300). Two hours after performing step 6.3.1.3.2 record PIPA TEMP.
- 6.3.1.4 Computer Power Turn On
  - 6.3.1.4.1 Press in +28VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11.
  - 6.3.1.4.2 Depress STBY pushbutton on DSKY for three seconds and verify STBY light on DSKY is OFF.
  - 6.3.1.4.3 On CRT, +28V LGC Operate Bus (GG1520) shall indicate between 24.5 and 33.5. Ignore computer alarm indications. Verify on event recorder that +28V LGC OP (GG 1523X) discrete is on. Using DSKY, enter VERB 36 ENTR then press RSET. All computer alarms shall clear.
  - 6.3.1.4.4 On CRT, the +14VDC LGC SUPPLY (GG 1020) shall indicate between 13.6 and 14.4 VDC. Record this value.
  - 6.3.1.4.5 On CRT, the +4VDC LGC SUPPLY (GG 1030) shall indicate between 3.8 and 4.2 VDC. Record this value.
- 6.3.1.5 LGC Operational Tests
  - 6.3.1.5.1 DSKY Check
    - 6.3.1.5.1.1 Initiate the DSKY check by entering in the DSKY:  
Press Error React  
VERB 57 ENTR 00015 ENTR (clear erasable memory)  
VERB 21 NOUN 27 ENTR  
00011 ENTR
    - 6.3.1.5.1.2 All the electroluminescent elements (PROG, VERB, NOUN and Row 1, Row 2, Row 3) shall display the decimal number nine (9). Including the 9's, the following shall be displayed for approximately 5 seconds.
      - a. 9's
      - b. 8's
      - c. 7's
      - d. 6's
      - e. 5's
      - f. 4's
      - g. 3's
      - h. 2's
      - i. 1's
      - j. 0's
      - k. Minus signs in Row 1, Row 2, Row 3
      - l. VERB-NOUN Flashing
      - m. COMP ACTY

On concurrently for 5 seconds

- e. Plus signs in ROW 1, ROW 2, ROW 3 } On concurrently for 5 seconds
- p. VERB-NOUN Flashing
- q. COMP ACTY
- r. COMP ACTY - On for 5 seconds then DSKY blanks

6.3.1.5.1.3 The DSKY pushbuttons shall be checked by entering:

VERB 25 NOUN 01 ENTR  
01740 ENTR  
+00123 ENTR  
-00456 ENTR  
-00789 DO NOT press ENTR

The DSKY shall display +00123 in Row 1, -00456, in Row 2, and -00789 in Row 3. Press CTR pushbutton three times on DSKY. Observe that Row 1, Row 2 and Row 3 are blank.

6.3.1.5.2 Lamp Test

6.3.1.5.2.1 Initiate the Lamp Test by entering in the DSKY:

VERB 35 ENTR

6.3.1.5.2.2 The following DSKY displays shall illuminate for approximately 5 seconds.

- a. UPLINK ACTY Row 1 and Row 2
- b. NO ATT
- c. STEY
- d. KEY REL
- e. TEMP
- f. GIMBAL LOCK
- g. PROG
- h. RESTART
- i. TRACKER
- j. OPR ERROR Flashing
- k. VERB-NOUN Flashing
- l. Plus 88888 in Row 1  
Row 2 and 3

} On currently for approximately 5 seconds.

6.3.1.5.3 Uplink Check

6.3.1.5.3.1 On K-START 148, set LOAD/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:

ERROR RESET  
VERB 25 NOUN 01 ENTR  
03375 ENTR  
+01234 ENTR  
-56789 ENTR  
+00000 ENTR

6.3.1.5.3.2 Verify the following is displayed on the DSKY

VERB 23 NOUN 01  
R1 + 01234  
R2 - 56789  
R3 +00000

6.3.1.5.4 Downlink Check

- 6.3.1.5.4.1 On CRT, DSKY display verify the following is displayed:  
VERB 23 NOUN 01  
R1 + 01234  
R2 - 56789  
R3 + 00000
- 6.3.1.5.5 LGC Self-Check
- 6.3.1.5.5.1 On K-148 enter the following sequence to initiate the LGC Self-Check:  
VERB 36 ENTER  
VERB 21 NOUN 27 ENTER  
TTTTT ENTER  
VERB 15 NOUN 01 ENTER  
01366 ENTER
- 6.3.1.5.5.2 On the CRT, verify that DSKY R1 does not display 01102 or 41102  
If a malfunction occurs, the following is displayed:  
R1 01102 or 41102  
R2 XXXXX c(S FAIL) program address +1 of point of failure  
R3 XXXXX number of fails
- 6.3.1.5.5.3 When R3 = 00002, stop the LGC Self Check by entering in K-148  
the following:  
VERB 21 NOUN 27 ENTER  
00000 ENTER
- 6.3.1.5.6 LGC Standby Check
- 6.3.1.5.6.1 On K-148 enter the following sequence:  
VERB 21 NOUN 10 ENTER  
00013 ENTER  
02000 ENTER
- 6.3.1.5.6.2 On DSKY depress STBY pushbutton for approximately 3 seconds.
- 6.3.1.5.6.3 Verify STBY status indicator lamp is ON.
- 6.3.1.5.6.4 On the CRT, verify the 3.2 KC 28V Supply (00 1331) is between  
28.04 and 29.16 V RMS.
- 6.3.1.5.6.5 On DSKY depress STBY pushbutton for approximately 3 seconds to  
return to LGC OPERATE mode.
- 6.3.1.5.6.6 Verify STBY status indicator lamp is OFF.
- 6.3.2 Alarms and Interrupts Test
- 6.3.2.1 Parity Fail Test
- 6.3.2.1.1 On K-148 enter the following sequence  
VERB 21 NOUN 02 ENTER  
03377 ENTER  
33777 ENTER

- 6.3.2.1.2 On CRT, DECK display, verify R1 = 33777 and R3 = 03877
- 6.3.2.1.3 On K-148 enter the following sequence
- VERB 25 NOUN 26 ENTER  
04000 ENTER  
01777 ENTER  
00006 ENTER  
VERB 30 ENTER
- 6.3.2.1.4 Verify RESTART, and PGWCS CAUTION lamps are ON.
- 6.3.2.1.5 On K-148 enter VERB 36 ENTER. Press ERROR RESET pushbutton. All alarms shall clear.
- 6.3.2.2 Rupt Lock-Interrupt Too Long
- 6.3.2.2.1 On K-148 enter the following sequence
- VERB 24 NOUN 01 ENTER  
03377 ENTER  
30001 ENTER  
03377 ENTER  
VERB 25 NOUN 26 ENTER  
00001 ENTER  
01777 ENTER  
00006 ENTER  
VERB 31 ENTER
- 6.3.2.2.2 Verify RESTART, and PGWCS CAUTION lamps are ON.
- 6.3.2.2.3 On K-148 enter VERB 36 ENTER. Press ERROR RESET pushbutton. All alarms shall clear.
- 6.3.2.3 TC Trap Test
- 6.3.2.3.1 On K-148 enter the following sequence
- VERB 21 NOUN 01 ENTER  
03377 ENTER  
03377 ENTER  
VERB 25 NOUN 26 ENTER  
04000 ENTER  
01777 ENTER  
00006 ENTER  
VERB 30 ENTER
- 6.3.2.3.2 Verify RESTART, and PGWCS CAUTION lamps are ON.
- 6.3.2.3.3 On K-148 enter VERB 36 ENTER. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.4 Nightwatchman Test

6.3.2.4.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTER  
03377 ENTER  
30001 ENTER  
03377 ENTER  
VERB 25 NOUN 26 ENTER  
03400 ENTER  
01777 ENTER  
00008 ENTER  
VERB 30 ENTER

6.3.2.4.2 Verify RESTART, and POWCS CAUTION lamps are ON.

6.3.2.4.3 On K-148 enter VERB 36 ENTER. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.3 IMU OPERATE POWER ON TESTS

CAUTION

Prior to application of IMU OPERATE power in step 6.3.3.1.4, LGC OPERATE and IMU STANDBY power must have been applied to the G&N System continuously for a minimum of two hours. The only exception is when the requirements of step 6.2.4.10 are met and this does not apply for the initial application of IMU OPERATE power.

6.3.3.1 Verification of Power Turn-On

6.3.3.1.1 Set up analog recorder to monitor the following signals:

| SIGNAL NO. | SIGNAL NAME          |
|------------|----------------------|
| a. GG 2136 | MG Servo Error Total |
| b. GG 2106 | IG Servo Error Total |
| c. GG 2166 | OG Servo Error Total |
| d. GG 2112 | IG 1X Resolver Sine  |
| e. GG 2172 | OG 1X Resolver Sine  |
| f. GG 2142 | MG 1X Resolver Sine  |
| g. GG 1201 | IMU 25V 14 800 cps   |
| h. SPARE   |                      |

6.3.3.1.2 Start analog recorder to a chart speed of 5 mm/sec. Start event recorder at a chart speed of 1.0 mm/sec.

6.3.3.1.3 On CRT, monitor +120 VDC PIPA SUPPLY (GG 1040) and IMU gimbal angles.

6.3.3.1.4 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.3.3.1.5 Verify on analog recorder that the oscillations of the resolver sine signals (GG 2112, GG 2172, and GG 2142) are not sustained and that the signals damp out within 15 seconds. If they don't, remove IMU OPERATE power as soon as possible.

- 6.3.3.1.6 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90 ± 10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.
- 6.3.3.1.7 On event recorder verify the following:  
LGC WARNING is OFF (GG 9001)  
ISS WARNING is OFF (GG 9002)  
FGNCS CAUTION is OFF (GG 9003)
- 6.3.3.1.8 On CRT, verify all IMU gimbal angles indicate between 358 and 002.
- 6.3.3.1.9 On K-148 enter the following sequence:  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER
- 6.3.4 Temperature Control Verification
- 6.3.4.1 When 15 minutes have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP (GG 2300).
- 6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIG TEMP (GG 2301).
- 6.3.4.3 When 1 hour has elapsed from the time of IMU OPERATE power turn-on, monitor PIPA TEMP (GG 2300) and IRIG TEMP (GG 2301) on the CRT. Monitor and record temperature readings every 5 minutes for one hour. Verify that each reading does not deviate from the average value of each signal by more than 0.1°F.
- 6.3.4.4 When 2 hours have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP and IRIG TEMP. The PIPA Temp shall be 130.5 (±1.5)°F. The IRIG TEMP shall be 135 (±2.5)°F.
- 6.3.4.5 The PIPA TEMP recorded in step 6.3.4.4 shall be within 0.5°F of temperature recorded in steps 6.3.4.3.5 and 6.3.4.1.
- 6.3.4.6 The IRIG TEMP recorded in step 6.3.4.4 shall be within 0.5°F of the temperature recorded in step 6.3.4.2.
- 6.3.5 FGNCs Power Supply Tests
- 6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.
- 6.3.5.2 The PIPA Calibration Module Temperature (GG 6020) shall be between +45 and +90 DEG F.
- 6.3.5.3 The PBA Temperature (GG 6021) shall be between +60 and +110 DEG F.

- 6.3.5.4 The LGC Temperature (GG 4300) shall be between +45 and +130 DEG. F.
- 6.3.5.5 The +28 VDC IMU OPERATE BUS (GG 1500) shall be between 24.5 and 33.5 VDC.
- 6.3.5.6 The +28 VDC IMU STANDBY BUS (GG 1510) shall be between 24.5 and 33.5 VDC.
- 6.3.5.7 The +28 VDC LGC OPERATE BUS (GG 1520) shall be between 24.5 and 33.5 VDC.
- 6.3.5.8 The +120 VDC PIPA Supply (GG 1040) shall be between 114 and 126 VDC.
- 6.3.5.9 The -28 VDC Supply (GG 1100) shall be between -21.5 and -33.5 VDC.
- 6.3.5.10 The +4 VDC CDU Supply (GG 1070) shall be between 3.8 and 4.2 VDC.
- 6.3.5.11 The IMU 28V/800 CPS 1 pct Supply (GG 1201) shall be between 27.44 and 28.56 VRMS.
- 6.3.5.12 The IMU 28V 800 CPS 5 pct 90 PH Supply (GG 1202) shall be between 26.6 and 29.4 VRMS.
- 6.3.5.13 The IMU 28V 800 CPS 5 pct 0 PH Supply (GG 1203) shall be between 25.9 and 30.1 VRMS.
- 6.3.5.14 The 3.2 KC 28V Supply (GG 1331) shall be between 28.04 and 29.16 VRMS.
- 6.3.5.15 The 2.5 VDC T/M Bias (GG 1110) shall be between 2.4 and 2.6 VDC.
- 6.3.5.16 The +14 VDC LGC Supply (GG 1020) shall be between 13.6 and 14.4 VDC.
- 6.3.5.17 The +4 VDC LGC Supply (GG 1030) shall be between 3.8 and 4.2 VDC.
- 6.3.5.18 The phase difference between the 3.2 KC supply and LGC sync shall be  $0 \pm 10^\circ$  (NG 1336).
- 6.3.6 IMU OPERATIONAL TEST
  - 6.3.6.1 On K-148 enter the following:  
  
VERB 01 NOUN 10 ENTR  
00003 ENTR  
Record CRT DSKY Row 1 indication AAAAA and the time of day.



6.3.6.2 On K-148 enter the following:

VERB 21 NOUN 01 ENTR  
03377 ENTR  
AAAAA ENTR  
VERB 06 NOUN 02 ENTR  
03377 ENTR  
Record CRT DSKY Row 1 indication as ±BBBBB

6.3.6.3 Perform the following calculations:

- a.  $\frac{BBBBB \times 5.12}{3600} = CCCC.C$  (Contents (hrs) of high order scalar register)
- b.  $23.3 - CCCC.C = DDDD.D$  hours
- c.  $DDDD.D + \text{time of day recorded in 6.3.6.1} = \text{time of day at which high order scalar register will overflow.}$

6.3.6.4 If time of day is within 12 minutes of that calculated in 6.3.6.3.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.6.3.c has passed and proceed.

6.3.6.5 In K-148 enter the following sequence:

VERB 57 ENTR  
00004 ENTR  
VERB 34 ENTR

6.3.6.6 Wait 200 seconds, then verify on the CRT, that the X, Y and Z PIPA SG Output signals all indicate  $0.0 \pm 2.5$  Volts but not 0.

6.3.6.7 Approximately 12 minutes after performing step 6.3.6.1, VERB 06 NOUN 06 shall flash.

6.3.6.8 From the CRT, DSKY display, read and record R1 and R2 (local gravity whole and fractional respectively). The value recorded shall be between 975.0 and 985.9 cm/sec<sup>2</sup>.

6.3.6.9 On K-148 enter the following sequence

VERB 33 ENTR  
VERB 06 NOUN 66 shall flash.

6.3.6.10 From the CRT, DSKY display, read and record the horizontal fractional component of earth rate acting on the X, Y, and Z IRIG's as displayed in R2. The value recorded shall be between .77882 and .97882.

6.3.6.11 Terminate the test by entering in K-148 the following:

VERB 36 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR

6.3.7 PGNCB Operational Test

6.3.7.1 Start the PGNCB Operational test by inserting the following sequence into K-148:

VERB 57 ENTR  
00010 ENTR  
Program 07 shall be displayed  
VERB 33 NOUN 01 is displayed flashing

- 6.3.7.2 Command Accuracy 0°
- 6.3.7.2.1 On K-148, press ENTER  
VERB 33 NOUN 02 is displayed flashing  
Press ENTER  
VERB 33 NOUN 03 is displayed flashing
- 6.3.7.2.2 Read and record the CRT IMU Gimbals angles. The indications shall be  $000 \pm 001$  degrees.
- 6.3.7.2.3 Read and record CRT the DSKY Rows 1, 2, and 3 indications. The indications shall be  $+00000 \pm 00007$ .
- 6.3.7.3 Command Accuracy 45°
- 6.3.7.3.1 On K-148, press ENTER, VERB 33 NOUN 04 is displayed flashing after approximately 20 seconds.
- 6.3.7.3.2 Read and record the CRT IMU Gimbal angle. The indications shall be  $045 \pm 001$  degrees.
- 6.3.7.3.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be  $+04500 \pm 00007$ .
- 6.3.7.4 CDU Repeating Accuracy 45°
- 6.3.7.4.1 On K-148 press ENTER. In about 90 seconds VERB 05 NOUN 30 is displayed flashing.
- 6.3.7.4.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 7777 and 00003.
- 6.3.7.5 Command Accuracy 90°
- 6.3.7.5.1 On K-148 Press VERB 33, ENTER. In approximately 20 seconds VERB 33 NOUN 06 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.5.2 Read and record the CRT IMU Gimbal angle. The indications shall be  $090 \pm 001$  degrees.
- 6.3.7.5.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be  $+09000 \pm 00007$ .
- 6.3.7.6 Command Accuracy 135°
- 6.3.7.6.1 On K-148 press ENTER. In approximately 20 seconds VERB 33 NOUN 07 is displayed flashing.

- 6.3.7.6.2 Read and record the CRT IMU Gimbal Angle indication. The indications shall be  $135 \pm 001$  degrees.
- 6.3.7.6.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be  $+13500 \pm 00007$ .
- 6.3.7.7 On K-148 press ENTTR. In approximately 20 seconds VERB 33 NOUN 10 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall not be lighted.
- 6.3.7.8 CDU Repeating Accuracy  $135^\circ$ .
- 6.3.7.8.1 On K-148 press ENTTR pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.
- 6.3.7.8.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.
- 6.3.7.9 + Gimbal Lock Test
- 6.3.7.9.1 On K-148, Press VERB 33, ENTTR. In approximately 20 seconds VERB 33 NOUN 12 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.10 Command Accuracy  $225^\circ$ .
- 6.3.7.10.1 On K-148 press ENTTR. In approximately 20 seconds, VERB 33, NOUN 13 is displayed flashing.
- 6.3.7.10.2 Read and record the CRT IMU Gimbal Angle indications. The indication shall be  $225 \pm 001$  degrees.
- 6.3.7.10.3 Read and record CRT DSKY Rows 1, 2, and 3 indications. The indications shall be  $+22500 \pm 00007$ .
- 6.3.7.11 On K-148 press ENTTR. In approximately 20 seconds VERB 33 NOUN 14 is displayed. The GIMBAL LOCK lamp shall not be lighted.
- 6.3.7.12 CDU Command Rate Test
- 6.3.7.12.1 On K-148 press ENTTR. In approximately 30 seconds VERB 06 NOUN 66 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.12.2 Read and record the CRT DSKY Row 1, 2, and 3 indications. The indication shall be between 00012 and 00016.
- 6.3.7.12.3 On K-148 insert VERB 33 ENTTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.
- 6.3.7.12.4 On K-148 insert VERB 33 ENTTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on the DSKY shall not be lighted.

- 6.3.7.13 Command Accuracy 315°.
  - 6.3.7.13.1 On K-148 insert VERB 33 ENTER. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.
  - 6.3.7.13.2 Read and record CRT IMU Gimbal Angles: DIT. The indicator shall be 315 ± 001 degrees.
  - 6.3.7.13.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +31500 ± 00007.
- 6.3.7.14 CDU Repeating Accuracy 315°.
  - 6.3.7.14.1 On K-148 press ENTER. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.
  - 6.3.7.14.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.
- 6.3.7.15 Gimbal Lock Test
  - 6.3.7.15.1 On K-148 Press VERB 33 ENTER. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.16 CDU Repeating Accuracy 225°.
  - 6.3.7.16.1 On K-148 press ENTER. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.
  - 6.3.7.16.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be between 77774 and 00003.
- 6.3.7.17 On K-148 Press VERB 33 ENTER. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.
- 6.3.7.18 IMU CDU Fine Fail Test
  - 6.3.7.18.1 On K-148 insert the following sequence
    - +00100 ENTER
    - +00100 ENTER
    - +00100 ENTER
    - On Event Module verify that ISS WARNING lamp lights.
  - 6.3.7.18.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display Row 1 indicates 33XXX or 32XXX.

- 6.3.7.19 IMU CDU Coarse Fail Test
- 6.3.7.19.1 On K-148 insert the following sequence
- VERB 33 ENTR  
+03750 ENTR  
+03750 ENTR  
+03750 ENTR  
Verify that ISS WARNING lamp Event Module lights.
- 6.3.7.19.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed.  
Verify that CRT DSKY display of Row 1 indicates 33XXX or 32XXX.
- 6.3.7.20 FIM Linearly Test
- 6.3.7.20.1 On K-148 enter VERB 33 ENTR  
VERB 33 NOUN 27 shall be displayed.
- 6.3.7.20.2 On CRT verify the following:
- PITCH ATT ERROR is between +15.3 and +18.7 DEG (OG 2219)  
YAW ATT ERROR is between +15.3 and +18.7 DEG (OG 2249)  
ROLL ATT ERROR is between +15.3 and +18.7 DEG (OG 2279)
- 6.3.7.20.3 On K-148 press ENTR.  
VERB 33 NOUN 30 shall be displayed.
- 6.3.7.20.4 On CRT verify the following:
- PITCH ATT ERROR is between +14.4 and +17.6 DEG (OG 2219)  
YAW ATT ERROR is between +14.4 and +17.6 DEG (OG 2249)  
ROLL ATT ERROR is between +14.4 and +17.6 DEG (OG 2279)
- 6.3.7.20.5 On K-148 press ENTR.  
VERB 33 NOUN 31 shall be displayed.
- 6.3.7.20.6 On CRT verify the following:
- PITCH ATT ERROR is between +05.4 and +06.6 DEG (OG 2219)  
YAW ATT ERROR is between +05.4 and +06.6 DEG (OG 2249)  
ROLL ATT ERROR is between +05.4 and +06.6 DEG (OG 2279)
- 
- 6.3.7.20.7 On K-148 press ENTR.  
VERB 33 NOUN 32 shall be displayed.

6.3.7.20.8 On CRT verify the following:

PITCH ATT ERROR is between +00.2 and -00.2 DEG (OG 2219)  
YAW ATT ERROR is between +00.2 and -00.2 DEG (OG 2249)  
ROLL ATT ERROR is between +00.2 and -00.2 DEG (OG 2279)

6.3.7.20.9 On K-148 press ENTER.  
VERB 33 NOUN 33 shall be displayed.

6.3.7.20.10 On CRT verify the following:

PITCH ATT ERROR is between -05.4 and -06.6 DEG (OG 2219)  
YAW ATT ERROR is between -05.4 and -06.6 DEG (OG 2249)  
ROLL ATT ERROR is between -05.4 and -06.6 DEG (OG 2279)

6.3.7.20.11 On K-148 press ENTER.  
VERB 33 NOUN 34 shall be displayed.

6.3.7.20.12 On CRT verify the following:

PITCH ATT ERROR is between -14.4 and -17.6 DEG (OG 2219)  
YAW ATT ERROR is between -14.4 and -17.6 DEG (OG 2249)  
ROLL ATT ERROR is between -14.4 and -17.6 DEG (OG 2279)

6.3.7.20.13 On K-148 press ENTER.  
VERB 33 NOUN 35 shall be displayed.

6.3.7.20.14 On CRT verify the following:

PITCH ATT ERROR is between -15.3 and -18.7 DEG (OG 2219)  
YAW ATT ERROR is between -15.3 and -18.7 DEG (OG 2249)  
ROLL ATT ERROR is between -15.3 and -18.7 DEG (OG 2279)

6.3.7.21 On K-148 enter VERB 36 ENTER.

The proper operation of the IMU CAGE function (consisting of steps 6.3.7.21 thru 6.3.7.23) need be performed only once during the initial PGWCS Operational Test and omitted from subsequent testing of test 6.3.7.

6.3.7.21.1 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTER  
+00500 ENTER  
+00500 ENTER  
+00500 ENTER

6.3.7.21.2 On the CRT, verify all IMU gimbal angles indicate between 003 and 007 DEG.

6.3.7.21.3 On analog recorder, monitor the following signals:

| SIGNAL NO. | SIGNAL NAME          |
|------------|----------------------|
| a. GG 2136 | MG Servo Error Total |
| b. GG 2106 | IG Servo Error Total |
| c. GG 2166 | OG Servo Error Total |
| d. GG 2112 | IG LX Resolver Sine  |
| e. GG 2172 | OG LX Resolver Sine  |
| f. GG 2142 | MG LX Resolver Sine  |
| g. GG 1201 | IMU 28V 15 800 cps   |

6.3.7.21.4 Start analog recorder to a chart speed of 5 mm/sec.

6.3.7.21.5 On LEM Cabin Panel 4, hold IMU CAGE momentary toggle switch in the ON position. (Do not release).

6.3.7.21.6 On analog recorder, verify the LX Resolver Sine signals (GG 2112, GG 2172, GG 2142) null out to less than 0.5 VRMS. Release IMU CAGE switch to the OFF position. Disregard any momentary transients on the LX Resolver Sine signals when the switch is released. Any sustained oscillations shall be cause for immediate removal of IMU Operate power.

6.3.7.21.7 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.7.22 Stop analog recorder.

6.3.7.23 On K-148 enter the following sequence:

```

VERB 36 ENTER
VERB 41 NOUN 20 ENTER
+00700 ENTER
+00700 ENTER
+00700 ENTER

```

6.3.7.24 On CRT verify the following:

```

IG LX Resolver Sin (11°) is between +8.5 and +8.5 DEG (GG 2121)
MG LX Resolver Sin (11°) is between +8.5 and +8.5 DEG (GG 2151)
OG LX Resolver Sin (11°) is between +8.5 and +8.5 DEG (GG 2181)

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6.3.7.25 On K-148 enter the following:

```

VERB 41 NOUN 20 ENTER
+00000 ENTER
+00000 ENTER
+00000 ENTER

```



6.3.8 IRIG Scale Factor Determination

6.3.8.1 Insure that the IMU operate power and LGC Operate power have been applied for a minimum of one hour and that the IMU is not in a gimbal lock condition.

6.3.8.2 On meter module monitor and record IRIG TEMP (GG2301) and PIPA TEMP (GG2300).

6.3.8.3 On K-148 enter the following sequence.

VERB 57 ENTR  
00005 ENTR

6.3.8.4 PROG 07 shall be displayed.

6.3.8.5 VERB 06 NOUN 61 shall flash.

6.3.8.6 On the CRT DSKY, verify contents of Row 1 (Navigation Base Azimuth) and Row 2 (Site latitude shall be displayed).

6.3.8.7 If values for Row 1 and Row 2 are correct, proceed to the next step.  
If values for Row 1 and Row 2 are incorrect, enter the following sequence into K-148:

VERB 24 ENTR  
+xxxxx ENTR (Correct navigation base azimuth)  
+28.516 ENTR (Correct site latitude)  
Verify values in Row 1 and Row 2 are correct.

6.3.8.8 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)  
+00001 ENTR

NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.8.

6.3.8.9 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (-X IRIG Scale Factor error in part per million, Position +00001)

6.3.8.10 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)  
+00002 ENTR

NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.10.

6.3.8.11 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per million Position +00002).

6.3.8.12 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)  
+00003 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is ON, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.12.

6.3.8.13 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position +00003).

6.3.8.14 On K-148 enter the following sequence:

VERB 33 ENTR (VERB 21 NOUN 30 shall flash)  
-00001 ENTR

NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.14.

6.3.8.15 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row (+X IRIG Scale Factor error in parts per million, Position -00001).

- 6.3.8.16 On K-148 enter the following sequence:  
 VERB 33 ENTER (VERB 21 NOUN 30 shall flash)  
 -00002 ENTER  
 NOTE: If PROG lamp changes from 07 to 00 during the next step, or  
 PROG ALARM lamp is ON, enter VERB 36 ENTER and repeat steps  
 6.3.8.3 through 6.3.8.7 and 6.3.8.16.
- 6.3.8.17 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and  
 record from CRT DEKY Row 1 (+Y IRIQ Scale Factor error in parts per  
 million, Position -00002).
- 6.3.8.18 On K-148 enter the following sequence:  
 VERB 33 ENTER (VERB 21 NOUN 30 shall flash)  
 -00003 ENTER  
 NOTE: If PROG lamp changes from 07 to 00 during the next step, or  
 PROG ALARM is ON, enter VERB 36 ENTER and repeat steps,  
 6.3.8.3 through 6.3.8.7 and 6.3.8.18.
- 6.3.8.19 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and  
 record from CRT DEKY Row 1 (-Z IRIQ Scale Factor error in parts per  
 million, Position -00003).
- 6.3.8.20 Repeat steps 6.3.8.8 through 6.3.8.19 twice to obtain second and third  
 set of data.
- 6.3.8.21 Terminate this test by entering in K-148 the following:  
 VERB 34 ENTER  
 VERB 41 NOUN 20 ENTER  
 +00000 ENTER  
 +00000 ENTER  
 +00000 ENTER
- 6.3.8.22 The average of the three readings of Scale Factor Error for each of  
 the 6 positions shall be  $0 \pm 1750$  PPM.
- 6.3.9 IMU performance Test. A reference data sheet is provided at the end  
 of this section to aid in data reduction. This test should be completed before the IMU is used in flight.
- 6.3.9.1 Insure that IMU Operate power and LOC Operate power has been applied  
 for a minimum of one hour and that the IMU is not in a Gimbal Lock  
 condition.
- 6.3.9.2 On CRT display, monitor and record IRIQ TEMP (00 2301) and PIPA TEMP  
 (00 2300).
- 6.3.9.3 Adjust oscilloscope to display butterfly of X PIPA.

6.3.9.4 On K-148 enter the following:

VERB 01 NOUN 10 ENTR  
00003 ENTR  
Record CRT DSKY Row 1 indication AAAAA and the time of day.

6.3.9.5 On K-148 enter the following:

VERB 21 NOUN 01 ENTR  
03377 ENTR  
AAAAA ENTR  
VERB 06 NOUN 02 ENTR  
03377 ENTR  
Record CRT DSKY Row 1 indications as ±BBBBB.

6.3.9.6 Perform the following calculations:

- a.  $\frac{BBBBB \times 5.12}{360} = CCCC.C$  (Contents (hrs) of high order scalar register)
- b.  $23.3 - CCCC.C = DDDD.D$  hours.
- c.  $DDDD.D + \text{present time of day} = \text{time of day at which high order scalar register will overflow.}$

6.3.9.7 If the time of day is within 12 minutes of that calculated in 6.3.9.6.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.9.6.c has passed and proceed.

Paragraph

6.3.9.15  
6.3.9.22  
6.3.9.30  
6.3.9.36  
6.3.9.43  
6.3.9.48

6.3.9.8 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTR  
00366 ENTR  
Record contents of Row 1 XXXXY  
VERB 21 NOUN 01 ENTR  
00366 ENTR  
XXXXY' ENTR  
Where Y' is obtained from Table II.  
VERB 57 ENTR  
00001 ENTR  
VERB 06 NOUN 61 shall flash

6.3.9.9 On the CRT, DSKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.

- 6.3.9.10 If values for R1 and R2 are correct, proceed to next step.  
If values for R1 and R2 are incorrect, enter the following sequence into K-148.
- VERB 24 ENTR  
xxxx.xx ENTR (Correct navigation base azimuth  $\pm 0.50$  deg)  
+28.516 ENTR (Correct site latitude)  
Verify values in R1 and R2 are correct
- 6.3.9.11 On K-148 enter the following sequence:
- VERB 33 ENTR  
VERB 06 NOUN 66 shall flash
- 6.3.9.12 On CRT, DSKY display, verify R1 = +00600 (Time),  
R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position).  
If values for R1, R2 and R3 are correct, proceed to next step.  
If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- VERB 25 ENTR  
+00600 ENTR (Test Time in Seconds)  
+00000 ENTR (Test Index Number)  
+00001 ENTR (Test Position Entry)
- 6.3.9.13 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.3.9.14 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 (+R1DY Position +00001).
- 6.3.1.15 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.3.9.16 After 100 seconds, take a photograph of Y and Z PIPA butterfly patterns on oscilloscope.
- 6.3.9.17 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (+X PIPA Position +00001). Row 1 is whole part, Row 2 is fractional part. Units are cm/sec<sup>2</sup>.
- 6.3.9.18 On K-148 enter the following sequence:
- VERB 34 ENTR  
VERB 06 NOUN 66 shall flash
- 6.3.9.19 On CRT, DSKY display - verify R1 = +00600, R2 = +00000, and R3 = +00002
- 6.3.9.20 On K-148 enter the following sequence:
- VERB 33 ENTR

- 6.3.9.21 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DEKY display record R2 (+HBMZ Position +00002).
- 6.3.9.22 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.23 Approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DEKY display record R1 and R2 (-X PIPA Position +00002).
- 6.3.9.24 On K-148 enter the following sequence:  
VERB 33 ENTR  
Record CRT gimbal angle indications and time.
- 6.3.9.25 In approximately 67 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DEKY display record R2 (-HBMX + ADIAX Pos +00002). Record CRT gimbal angle indications and time.
- 6.3.9.26 On K-148 enter the following sequence:  
VERB 34 ENTR  
VERB 06 NOUN 66 shall flash
- 6.3.9.27 On CRT, DEKY display, verify R1 = +00600, R2 = +00000, and R3 = +00003.
- 6.3.9.28 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.29 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DEKY display record R2 (-HBMX Position +00003).
- 6.3.9.30 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.31 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DEKY display record R1 and R2 (+Z PIPA Position +00003).
- 6.3.9.32 On K-148 enter the following sequence:  
VERB 34 ENTR  
VERB 06 NOUN 66 shall flash.
- 6.3.9.33 On the CRT, DEKY display verify R1 = +00600, R2 = 00000, and R3 = +00004.
- 6.3.9.34 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.35 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DEKY display record R2 (+HBDY + ADERAY Position +00004).

- 6.3.9.36 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.37 After 100 seconds, take a photograph of the X-PIPA butterfly pattern on oscilloscope.
- 6.3.9.38 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-Z PIPA Position +00004).
- 6.3.9.39 On K-148 enter the following sequence:  
VERB 33 ENTER  
Record CRT gimbal angle indications and time.
- 6.3.9.40 In approximately 67 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display record R2 (+NBDZ + ADIAZ Position +00004). Record CRT gimbal angle indications and time.
- 6.3.9.41 On K-148 enter the following sequence:  
VERB 33 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.42 From the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00005.
- 6.3.9.43 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.44 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.
- 6.3.9.45 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Y PIPA Position +00005).
- 6.3.9.46 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.47 On the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00006.
- 6.3.9.48 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.49 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.
- 6.3.9.50 In approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2. (-Y PIPA Position +00006).
- 6.3.9.51 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash

- 6.3.9.52 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000 and R3 = +00007.
- 6.3.9.53 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+.707 ADRAX - NBDX Position +00007).
- 6.3.9.55 On K-148 enter the following sequence:  
VERB 34 ENTR  
VERB 06 NOUN 66 shall flash
- 6.3.9.56 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00008.
- 6.3.9.57 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 -.707 (NBDZ+NBDY) +0.5 (ADRAY + ADRAZ) +0.5 (ADIAZ - ADIAY) (Position +00008).
- 6.3.9.59 On K-148 enter the following:  
VERB 34 ENTR  
VERB 06 NOUN 66 shall flash.
- 6.3.9.60 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00009.
- 6.3.9.61 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADRAZ Position +00009).
- 6.3.9.63 On K-148 enter the following sequence:  
VERB 34 ENTR  
VERB 06 NOUN 66 shall flash
- 6.3.9.64 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00010.
- 6.3.9.65 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.66 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 [.707 (NBDY-NBDX) +.5 (ADIAY - ADIAX) +.5 ADRAX] (Position +00010).



6.3.9.67 Terminate this test by entering in K-148 the following:

VERB 36 ENTER

6.3.9.68 On CRT, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.69 On K-148 enter the following sequence:

VERB 41 MOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER

6.3.9.70 Calculations.  
NOTE: Use Post Vibration or System Test data points only.

6.3.9.70.1 Obtain data from last IRIG and/or PIPA test and fill in Data Sheet  $x_{1-1}$ .

6.3.9.70.2 Obtain data from second last IRIG and/or PIPA test and fill in Data Sheet  $x_{1-2}$ .

6.3.9.70.3 Obtain data from third last IRIG and/or PIPA test and fill in Data Sheet  $x_{1-3}$ .

6.3.9.70.4 Perform the following calculations for each item appearing on Data Sheet  $x_1$  and transfer all results to lines au through bi.

NOTE:

See paragraph 5.6 before continuing.

$$D_1 = |x_{1-1} - x_1|$$

$$D_2 = |x_{1-1} - x_1| + |x_{1-2} - x_{1-1}|$$

$$D_3 = |x_{1-3} - x_{1-2}| + |x_{1-2} - x_{1-1}| + |x_{1-1} - x_1|$$

## DATA SHEET

| ITEM NO.  | PARAMETER                                                                         | UNITS               | RECORDED VALUE      |   |
|-----------|-----------------------------------------------------------------------------------|---------------------|---------------------|---|
| 6.3.9. 14 | +N BDY<br>Transfer result to line af.                                             | meru                | ( ) ---,---         | a |
| 6.3.9. 17 | + X PIPA Test<br>Position +00001                                                  | cm/sec <sup>2</sup> | { } 00---,<br>----- | b |
| 6.3.9. 21 | +N BDZ<br>Position +00002<br>Transfer result to line ag.                          | meru                | ( ) ---,---         | c |
| 6.3.9. 23 | -X PIPA Test<br>Position +00002                                                   | cm/sec <sup>2</sup> | { } 00---,<br>----- | d |
| 6.3.9. 25 | -N BDX + ADIAX<br>Position +00002                                                 | meru                | { } ---,---         | e |
| 6.3.9. 29 | -N BDX<br>Position +00003<br>Multiply by -1 and transfer result to line ah.       | meru                | ( ) ---,---         | f |
| 6.3.9. 31 | +Z PIPA Test<br>Position +00003                                                   | cm/sec <sup>2</sup> | { } 00---,<br>----- | g |
| 6.3.9. 35 | +N BDY + ADERAY<br>Position +00004                                                | meru                | ( ) ---,---         | h |
| 6.3.9. 38 | -Z PIPA Test<br>Position +00004                                                   | cm/sec <sup>2</sup> | { } 00---,<br>----- | i |
| 6.3.9. 40 | +N BDZ + ADIAZ<br>Position +00004                                                 | meru                | ( ) ---,---         | j |
| 6.3.9. 45 | +Y PIPA Test<br>Position +00005                                                   | cm/sec <sup>2</sup> | { } 00---,<br>----- | k |
| 6.3.9. 50 | -Y PIPA Test<br>Position +00006                                                   | cm/sec <sup>2</sup> | { } 00---,<br>----- | l |
| 6.3.9. 54 | -NBIX + .707 ADERAX<br>Position +00007                                            | meru                |                     | m |
| 6.3.9. 58 | -.707 (NBIZ+NBIZY)<br>+.5 (ADIAZ-ADIAY)<br>+.5 (ADERAY+ADERAZ)<br>Position +00008 | meru                |                     | n |
| 6.3.9. 62 | -NBIZ + .707 ADERAZ<br>Position +00009                                            | meru                |                     | o |
| 6.3.9. 66 | .707 (NBIZ-NBIX)<br>+.5 (ADIAY-ADIAX)<br>+.5 ADERAX<br>Position +00010            | meru                |                     | p |

## DATA SHEET

| CALCULATION                                                                                                                                                                                                                 | PARAMETER    | UNITS               |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------|----|
| line c - line f = ( ) ---,--<br>(-NBDX+ADIAZ) - (-NBDX) Transfer result to line ai.                                                                                                                                         | ADIAZ        | meru                | q  |
| line h - line a = ( ) ---,--<br>(+NBDY+ADSRAX) - (-NBDY) Transfer result to line ai.                                                                                                                                        | ADSRAX       | meru                | r  |
| line j - line c = ( ) ---,--<br>(+NBDZ+ADIAZ) - (-NBDZ) Transfer result to line am.                                                                                                                                         | ADIAZ        | meru                | s  |
| (line m - line f) X 1.414 = ( ) ---,--<br>(-NBDX + .707 ADSRAX)<br>-(-NBDX) X 1.414 Transfer result to line ak.                                                                                                             | ADSRAX       | meru                | t  |
| (line o + line c) X 1.414 = ( ) ---,--<br>(-NBDZ + .707 ADSRAZ + NBDZ) X 1.414 Transfer result to line ai.                                                                                                                  | ADSRAX       | meru                | u  |
| (line p - .707 line a - .707 line f<br>+ .5 line q - .5 line t) X 2 = ---,--<br>[ .707 (NBDY-NBDX) + .5 (ADIAZ-ADIAZ) + .5 ADSRAX - .707<br>(-NBDX) - .707 NBDY + .5 ADIAZ - .5 ADSRAX ] X 2<br>Transfer result to line an. | ADIAZ        | meru                | v  |
| line b - line d = ( )                                                                                                                                                                                                       | PIPA X2G     | cm/sec <sup>2</sup> | w  |
| line k - line l = ( )                                                                                                                                                                                                       | PIPA Y2G     | cm/sec <sup>2</sup> | x  |
| line g - line i = ( )                                                                                                                                                                                                       | PIPA Z2G     | cm/sec <sup>2</sup> | y  |
| 1958.48 ÷ line w x 1 cm/sec/pulse =<br>Subtract 1.000000 from this value, multiply x 10 <sup>6</sup> and transfer results to line ao.                                                                                       | X PIPA S. F. | cm/sec/pulse        | z  |
| 1958.48 ÷ line x X 1 cm/sec/pulse =<br>Subtract 1.000000 from this value, multiply X 10 <sup>6</sup> and transfer results to line ap.                                                                                       | Y PIPA S. F. | cm/sec/pulse        | aa |
| 1958.48 ÷ line y X 1 cm/sec/pulse =<br>Subtract 1.000000 from this value, multiply X 10 <sup>6</sup> and transfer results to line aq.                                                                                       | Z PIPA S. F. | cm/sec/pulse        | ab |
| 1/2 (line b + line d) = ( ) ---,--<br>Transfer results to line ar.                                                                                                                                                          | X PIPA Bias  | cm/sec <sup>2</sup> | ac |
| 1/2 (line k + line l) = ( ) ---,--<br>Transfer results to line as.                                                                                                                                                          | Y PIPA Bias  | cm/sec <sup>2</sup> | ad |
| 1/2 (line g + line i) = ( ) ---,--<br>Transfer results to line at.                                                                                                                                                          | Z PIPA Bias  | cm/sec <sup>2</sup> | ae |

DATA SHEET  
(x<sub>1</sub>)

| PARAMETER                          | UNITS               | MIN<br>VALUE | RECORDED VALUE | MAX<br>VALUE | REJ | ACC |
|------------------------------------|---------------------|--------------|----------------|--------------|-----|-----|
| NBDY                               | meru                | -15          |                | +15          |     |     |
| NBDZ                               | meru                | -15          |                | +15          |     |     |
| NBDX                               | meru                | -15          |                | +15          |     |     |
| A <sub>1</sub> SRAY                | meru                | -40          |                | +40          |     |     |
| ADSRZ                              | meru                | -40          |                | +40          |     |     |
| ADSRAX                             | meru                | -40          |                | +40          |     |     |
| ADIA <sub>X</sub>                  | meru                | -100         |                | +100         |     |     |
| ADIA <sub>Z</sub>                  | meru                | -100         |                | +100         |     |     |
| ADIA <sub>Y</sub>                  | meru                | -100         |                | +100         |     |     |
| X PIPA S. F. error<br>from line z  | PPM                 | -1900        |                | +1900        |     |     |
| X PIPA S. F. error<br>from line aa | PPM                 | -1900        |                | +1900        |     |     |
| Z PIPA S. F. error<br>from line ab | PPM                 | -1900        |                | +1900        |     |     |
| X PIPA Bias<br>from line ac        | cm/sec <sup>2</sup> | -3.1         |                | +3.1         |     |     |
| X PIPA Bias<br>from line ad        | cm/sec <sup>2</sup> | -3.1         |                | +3.1         |     |     |
| Z PIPA Bias<br>from line ae        | cm/sec <sup>2</sup> | -3.1         |                | +3.1         |     |     |

af  
ag  
ah  
ai  
aj  
ah  
ai  
am  
an  
ao  
ap  
aq  
ar  
as  
at

DATA SHEET  
( $x_{t-1}$ )

| PARAMETER          | UNITS               | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDY               | meru                |                |
| NBDZ               | meru                |                |
| NBDX               | meru                |                |
| ADSRAY             | meru                |                |
| ADSRZ              | meru                |                |
| ADSRAX             | meru                |                |
| ADIAZ              | meru                |                |
| ADIAZ              | meru                |                |
| ADIAZ              | meru                |                |
| X PIPA S. F. error | PPM                 |                |
| Y PIPA S. F. error | PPM                 |                |
| Z PIPA S. F. error | PPM                 |                |
| X PIPA Bias        | cm/sec <sup>2</sup> |                |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                |

DATA SHEET  
( $x_{1-2}$ )

| PARAMETER          | UNITS               | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDY               | meru                |                |
| NBDZ               | meru                |                |
| NBDX               | meru                |                |
| ADSRAY             | meru                |                |
| ADSRZ              | meru                |                |
| ADIAZ              | meru                |                |
| ADIAZ              | meru                |                |
| ADIAZ              | meru                |                |
| X PIPA S. F. error | PPM                 |                |
| Y PIPA S. F. error | PPM                 |                |
| Z PIPA S. F. error | PPM                 |                |
| X PIPA Bias        | cm/sec <sup>2</sup> |                |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                |

DATA SHEET  
(4-3)

| PARAMETER          | UNITS               | RECORDED VALUE |
|--------------------|---------------------|----------------|
| NBDY               | meru                |                |
| NBDZ               | meru                |                |
| NBDX               | meru                |                |
| ADSRAY             | meru                |                |
| ADSRZ              | meru                |                |
| ADSRAX             | meru                |                |
| ADIAX              | meru                |                |
| ADIAZ              | meru                |                |
| ADIA Y             | meru                |                |
| X PIPA S. F. error | PPM                 |                |
| Y PIPA S. F. error | PPM                 |                |
| Z PIPA S. F. error | PPM                 |                |
| X PIPA Bias        | cm/sec <sup>2</sup> |                |
| Y PIPA Bias        | cm/sec <sup>2</sup> |                |
| Z PIPA Bias        | cm/sec <sup>2</sup> |                |

DATA SHEET

| PARAMETER    | UNITS               | D <sub>1</sub> | MAX | D <sub>2</sub> | MAX | D <sub>3</sub> | MAX |    |
|--------------|---------------------|----------------|-----|----------------|-----|----------------|-----|----|
| NBDY         | meru                |                | 6   |                | 9   |                | 11  | au |
| NBDZ         | meru                |                | 6   |                | 9   |                | 11  | av |
| NBDX         | meru                |                | 6   |                | 9   |                | 11  | aw |
| ADSRAY       | meru                |                | 14  |                | 21  |                | 25  | ax |
| ADSRAZ       | meru                |                | 14  |                | 21  |                | 25  | ay |
| ADSRAX       | meru                |                | 14  |                | 21  |                | 25  | az |
| ADLAX        | meru                |                | 17  |                | 33  |                | 40  | ba |
| ADLAZ        | meru                |                | 17  |                | 33  |                | 40  | bb |
| ADLAY        | meru                |                | 17  |                | 33  |                | 40  | bc |
| X PIPA S. F. | Error PPM           |                | 400 |                | 500 |                | 600 | bd |
| Y PIPA S. F. | Error PPM           |                | 400 |                | 500 |                | 600 | be |
| Z PIPA S. F. | Error PPM           |                | 400 |                | 500 |                | 600 | bf |
| X PIPA Bias  | cm/sec <sup>2</sup> |                | 0.5 |                | 0.7 |                | 0.9 | bg |
| Y PIPA Bias  | cm/sec <sup>2</sup> |                | 0.5 |                | 0.7 |                | 0.9 | bh |
| Z PIPA Bias  | cm/sec <sup>2</sup> |                | 0.5 |                | 0.7 |                | 0.9 | bi |



| Y | Y' |
|---|----|
| 0 | 2  |
| 1 | 3  |
| 2 | 2  |
| 3 | 3  |
| 4 | 6  |
| 5 | 7  |
| 6 | 6  |
| 7 | 7  |

TABLE II

- 6.3.10 LOC Voltage Margin Test
- 6.3.10.1 Initial Conditions
- 6.3.10.1.1 Insure that the G&N System is in the Standby Mode.
- 6.3.10.1.2 On the CRT, verify the +28 VDC LOC OPERATE bus is between 24.5 and 33.5 vdc (GG 1520).
- 6.3.10.2 Voltage Margin Determination
- 6.3.10.2.1 On the PSA Adapter Module (PSAAM) (410-31080), place INHIBIT VOLTAGE FAIL switch to ON.
- CAUTION:** The +4 vdc LOC Supply voltage shall never be operated lower than +2.5 vdc or higher than +5.2 vdc (GG 1030).
- The +14 vdc LOC Supply shall never be operated less than +8.5 vdc or higher than +17.0 vdc (GG 1020).
- NOTE:** The flashing indication of the LOC supplies may be disregarded for this test. The charts in Table III may be used to determine approximate values for the "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.
- 6.3.10.2.2 Enter 0001 into R155. Verify and execute.
- 6.3.10.2.3 Enter 1111 into R154. Verify and execute.
- 6.3.10.2.4 Enter in C-156 +XX.XD01114. (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 12.1 (+0.3, -0) vdc. See Table III. Execute.
- 6.3.10.2.5 Enter in C-156 +XX.XD01124 (Enter a value for XX.X which will adjust the +4V power supply (GG 1030) as monitored on the CRT, to 3.5 (+0.15, -0) vdc. See Table III. Execute.
- 6.3.10.2.6 On K-148 press ERROR RESET.
- 6.3.10.2.7 On K-148 initiate LOC Self-Check by entering the following:
- VERB 21 MOUW 27 ENTR  
77767 ENTR
- Wait 200 seconds. Verify RESTART lamp on the DSKY is not lit.
- 6.3.10.2.8 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.
- 6.3.10.2.9 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:
- VERB 21 MOUW 27 ENTR  
77767 ENTR

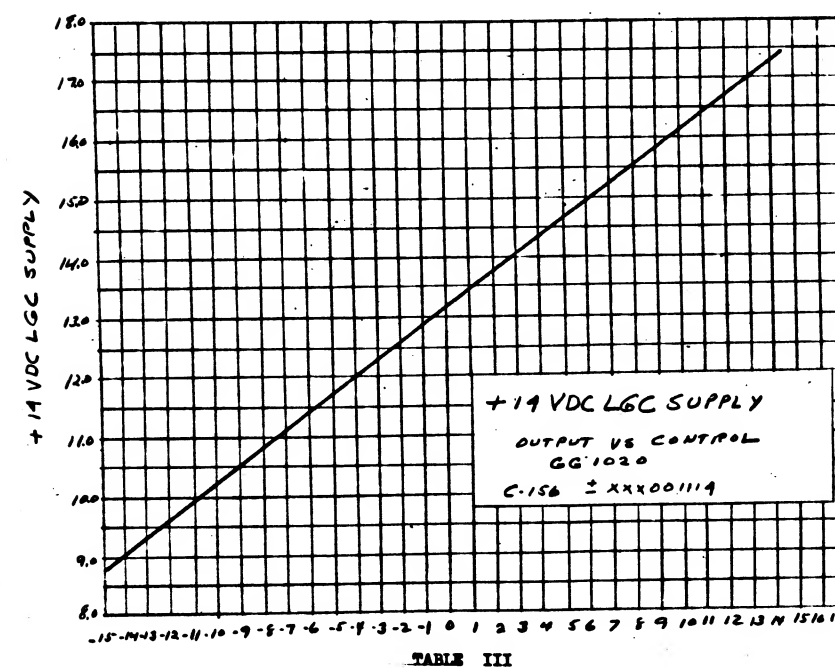
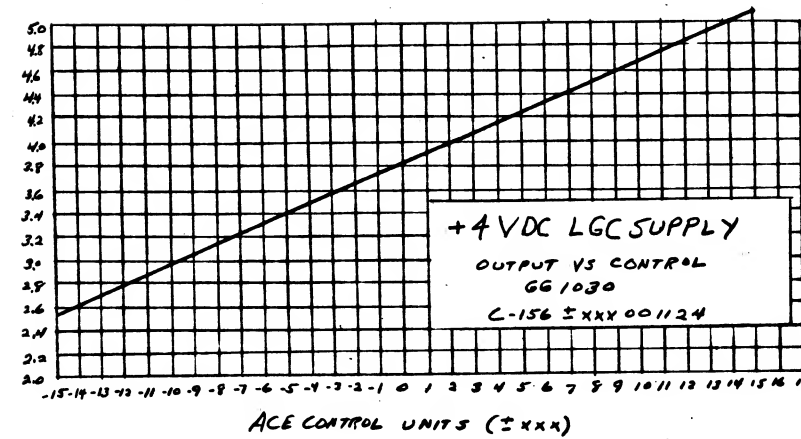


TABLE III

- 6.3.10.2.10 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the +14V power supply (OG 1020) as monitored on the CRT, to 16.4 (+0, -0.4) vdc. See Table III. Execute.
- 6.3.10.2.11 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.
- 6.3.10.2.12 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:
- VERB 21 MOUN 27 ENTR  
77767 ENTR
- 6.3.10.2.13 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the 4V power supply (OG 1030) as monitored on the CRT, to 4.5 (+0, -0.2) vdc. See Table III. Execute.
- 6.3.10.2.14 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.
- 6.3.10.2.15 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL Switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:
- VERB 21 MOUN 27 ENTR  
77767 ENTR
- 6.3.10.2.16 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the 14V power supply (OG 1020) as monitored on the CRT, to 12.1 (+0.3, -0) vdc. See Table III. Execute.
- 6.3.10.2.17 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.
- 6.3.10.2.18 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.
- 6.3.10.2.19 On R-154 enter 0000. Execute.
- 6.3.10.2.20 On R-155 enter 0000. Execute.
- 6.3.10.2.21 On K-148 terminate the LCC Self-Check by entering the following:
- VERB 21 MOUN 27 ENTR  
00000 ENTR
- 6.3.10.2.22 On K-148 press ERROR RESET.

- 6.3.11 LGC Clock Frequency Test
- 6.3.11.1 Insure that LGC Operate power has been applied for a minimum of 10 minutes before performing this test.
- 6.3.11.2 Verify that the counter is connected to the 3.2 kc signal on the hardline.
- 6.3.11.3 Insure that the counter has been warming up for a minimum of 30 minutes.
- 6.3.11.4 On the counter,  
Set the FUNCTION switch to: MAN START  
Set the TIME BASE switch to: 1 sec TIME UNIT/COUNT  
Set the SENSITIVITY control to: CHECK
- 6.3.11.5 Verify proper counter operation.
- 6.3.11.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.
- 6.3.11.7 Plug in the Preset unit and set:  
MODE switch to PRESET  
N switches to 96000
- 6.3.11.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.
- 6.3.11.9 Start counting by depressing RESET switch on counter.
- 6.3.11.10 After approximately 30 seconds, read and record counter display.
- 6.3.11.11 Repeat steps 6.3.11.9 and 6.3.11.10 nine times
- 6.3.11.12 The average of the 10 previous readings shall be  $30.000000 \pm 0.000060$  seconds.
- 6.3.11.13 Insure that the System is not in IMU Operate.
- 6.3.11.14 Perform the following DEKY operations.  
VERB 21 NOUN 10 ENTR  
00013 ENTR  
02000 ENTR
- Press and hold the STBY pushbutton on the DEKY for 3 seconds. Verify the Standby lamp is lighted.
- 6.3.11.15 Repeat steps 6.3.11.9 through 6.3.11.12.
- 6.3.11.16 Press and hold the STBY pushbutton on the DEKY for 3 seconds. Verify the Standby lamp is not lighted.

- 6.3.11.17 On the Computer Control and Reticle dimmer assembly, press and hold MARK X pushbutton.
- 6.3.11.18 On the DSKY observe  
VERB 05 HOUR 31  
Row 1 - 00112  
Prog Alarm lamp is lighted  
Press ERR RESET
- 6.3.11.19 Enter the following on K-148  
VERB 11 HOUR 10 ENTER  
00016 ENTER
- 6.3.11.20 Observe that DSKY Row 1 displays 00004.
- 6.3.11.21 Release MARK X pushbutton
- 6.3.11.22 Observe that DSKY Row 1 displays 00000.
- 6.3.11.23 Press and hold the MARK Y pushbutton on the Computer Control and Reticle Dimmer Assembly.
- 6.3.11.24 Observe that DSKY Row 1 displays 00010.
- 6.3.11.25 Release MARK Y pushbutton.
- 6.3.11.26 Observe that DSKY Row 1 displays 00000.
- 6.3.11.27 Press and hold the REJECT pushbutton on the Computer Control and Reticle Dimmer Assembly.
- 6.3.11.28 Observe that DSKY Row 1 displays 00020.
- 6.3.11.29 Release the REJECT pushbutton.
- 6.3.11.30 Observe that DSKY Row 1 displays 00000.
- 6.3.11.31 On the DSKY perform the following operation:  
VERB 36 ENTER
- 6.3.11.32 On the Computer Control and Reticle dimmer assembly, rotate the RETICLE BRIGHTNESS control to its minimum light intensity position. View through the AOT and verify that the reticle lamp is off.
- 6.3.11.33 While viewing through the AOT, slowly rotate the RETICLE BRIGHTNESS control to increase the reticle brightness until a stop is reached. Observe that the reticle brightness has increased in intensity. Return RETICLE BRIGHTNESS control to off state.

6.3.11.34 AOT eyepiece Heater Test.

6.3.11.34.1 Secure milliammeter HP 428B and current probe HP428A-21A.

6.3.11.34.2 Locate P1 at Computer Control and Reticle Dimmer assembly. Push lacing cord away from P1 back to fifth tie point.

6.3.11.34.3 Clip current probe HP428A-21A to blue wire in cable with red arrow pointing away from P1. Measure and record current indication. The current shall be between 139 and 244 ma.

6.3.11.34.4 Remove current probe, push lacing cord back to P1 and spot tie.

6.3.12 Gimbal Friction Test

6.3.12.1 Inner Gimbal Friction Test

6.3.12.1.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR

6.3.12.1.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.1.3 Set up Analog Recorder to monitor the following signals:

| MEAS. NO.  | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2110 | IG Torque Motor Current |
| b. GG 2106 | IG Servo Error Total    |
| c. GG 2107 | IG Servo Error In Phase |
| d. GG 2112 | IG 1x Resolver Sine     |
| e. GG 2113 | IG 1x Resolver Cosine   |
| f. GG 2220 | IG CDU Fine Error       |
| g. GG 1201 | IMU 28V 1 800 CPS       |

6.3.12.1.4 Set up Analog Recorder to monitor the following signals:

| MEAS. NO.  | SIGNAL NAME         |
|------------|---------------------|
| a. GG 2300 | PIPA TEMP           |
| b. GG 2301 | IRIG TEMP           |
| c. GG 1520 | +28 VDC LGC OPR BUS |

6.3.12.1.5 After 10 seconds has elapsed since step 6.3.12.1.1, enter the following into K-148:

VERB 21 NOUN 01 ENTR  
00403 ENTR  
00000 ENTR

6.3.12.1.6 Verify on CRT, DSKY display

VERB 21 NOUN 01  
R1 = 00000  
R3 = 00403

6.3.12.1.7 On K-148 enter the following sequence:

NOUN 15 ENTR  
00000 ENTR ENTR (Push ENTR pushbutton twice)  
Verify R1 = +00000  
37777 ENTR ENTR  
Verify R1 = 37777  
37743 ENTR ENTR  
Verify R1 = 37743  
00000 ENTR ENTR  
Verify R1 = 00000  
00000 ENTR (once)  
Verify R1 = 00000

6.2.12.1.8 Start analog recorders using a chart speed of 10 mm/sec (IG-360° TORQUE)

6.3.12.1.9 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTR  
00366 ENTR  
Records contents of Row 1 XXXXY  
VERB 21 NOUN 01 ENTR  
00366 ENTR  
XXXXY' ENTR  
Where Y' is obtained from Table II.  
VERB 42 ENTR  
VERB 33 ENTR



6.3.12.1.10 Monitor analog recorder. When the IG Torque Motor Current signal (GG 2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

6.3.12.1.11 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR

6.3.12.1.12 On the CRT, verify CDU X, CDU Y, CDU Z all indicate +00000 (+00200).

6.3.12.1.13 After 10 seconds has elapsed since step 6.3.12.1.11 enter the following sequence into K-148:

VERB 21 NOUN 01 ENTR  
00403 ENTR  
00000 ENTR

6.3.12.1.14 Verify on CRT, DSKY display.

VERB 21 NOUN 01  
R1 00000  
R3 00403

6.3.12.1.15 On K-148 enter the following sequence:

NOUN 15 ENTR  
00000 ENTR ENTR (Press ENTR pushbutton twice)  
Verify R1 = 00000  
40000 ENTR ENTR  
Verify R1 = 40000

6.3.12.1.15 (cont)

40034 ENTER ENTER  
Verify R1 = 40034  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER (once)  
Verify R1 = 00000

6.3.12.1.16 Start analog recorders using a chart speed of 10 mm/sec  
(IG +360° TORQUE)

6.3.12.1.17 On K-148 enter the following sequence

VERB 42 ENTER  
VERB 33 ENTER

6.3.12.1.18 Monitor analog recorder. When the IG Torque Motor Current signal  
(GG 2110) drops to a quiescent level (approximately 12 minutes), stop  
the recorders.

6.3.12.2 Outer Gimbal Friction Test

6.3.12.2.1 On K-148 enter the following sequence:

VERB 40 HOUN 20 ENTER Wait 3 seconds  
VERB 41 HOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER

6.3.12.2.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (+00200).

6.3.12.2.3 Set up analog recorder to monitor the following:

| MEAS NO.   | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2167 | OG Servo Error In Phase |
| b. GG 2170 | OG Torque Motor Current |
| c. GG 2166 | OG Servo Error Total    |
| d. GG 2280 | OG CDU Fine Error       |
| e. GG 2172 | OG 1X Resolver Sine     |
| f. GG 2173 | OG 1X Resolver Cosine   |

6.3.12.2.4 After 10 seconds has elapsed since step 6.3.12.2.1 enter the following  
sequence into K-148:

VERB 21 HOUN 01 ENTER  
00403 ENTER  
37777 ENTER

- 6.3.12.2.5 Verify on CRT, DSKY display
- VERB 21 NOUN 01  
R1 37777  
R3 00403
- 6.3.12.2.6 On K-148 enter the following sequence:
- NOUN 15 ENTR  
37743 ENTR (Press ENTR pushbutton twice)  
Verify R1 = 37743  
00000 ENTR ENTR  
Verify R1 = 00000  
00000 ENTR ENTR  
Verify R1 = 00000  
00000 ENTR ENTR  
Verify R1 = 00000  
00000 ENTR (once)  
Verify R1 = 00000
- 6.3.12.2.7 Start analog recorders using a chart speed of 10 mm/sec. (OG - 360° TORQUE)
- 6.3.12.2.8 On K-148 enter the following sequence:
- VERB 42 ENTR  
VERB 33 ENTR
- 6.3.12.2.9 Monitor analog recorder. When the OG Torque Motor Current signal (OG 2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.
- 6.3.12.2.10 On K-148 enter the following sequence:
- VERB 40 NOUN 20 ENTR Wait 3 seconds  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.3.12.2.11 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (+00200).
- 6.3.12.2.12 After 10 seconds has elapsed since step 6.3.12.2.10, enter the following sequence into K-148.
- VERB 21 NOUN 01 ENTR  
00403 ENTR  
40000 ENTR
- 6.3.12.2.13 Verify on CRT, DSKY display.
- VERB 21 NOUN 01  
R1 40000  
R3 00403

6.3.12.2.14 On K-148 enter the following sequence:

MOUW 15 ENTER  
40034 ENTER  
Verify R1 = 40034  
00000 ENTER  
Verify R1 = 00000  
00000 ENTER  
Verify R1 = 00000  
00000 ENTER  
Verify R1 = 00000  
00000 ENTER (once)  
Verify R1 = 00000

6.3.12.2.15 Start analog recorders using a chart speed of 10 mm/sec (OG +360° TORQUE)

6.3.12.2.16 On K-148 enter the following sequence

VERB 42 ENTER  
VERB 33 ENTER

6.3.12.2.17 Monitor analog recorder. When the OG Torque Motor Current signal (OG 2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.3 Middle Gimbal Friction Test

6.3.12.3.1 On K-148 enter the following sequence:

VERB 40 MOUW 20 ENTER Wait 3 seconds  
VERB 41 MOUW 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+06750 ENTER

6.3.12.3.2 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = +06750±00200.

6.3.12.3.3 Set up analog recorder to monitor the following:

| MEAS. NO.  | SIGNAL NAME             |
|------------|-------------------------|
| a. OG 2136 | MG Servo Error Total    |
| b. OG 2137 | MG Servo Error In Phase |
| c. OG 2150 | MG Torque Motor Current |
| d. OG 2143 | MG LX Resolver Cosine   |
| e. OG 2250 | MG CDU Fine Error       |
| f. OG 2142 | MG LX Resolver Sine     |

6.3.12.3.4 After 10 seconds have elapsed since step 6.3.12.3.1, enter the following sequence into K-148:

VERB 21 MOUW 01 ENTER  
00403 ENTER  
00000 ENTER

6.3.12.3.5 Verify on CRT, DSKY display

VERB 21 NOUN 01  
R1 = 00000  
R3 = 00403

6.3.12.3.6 On K-148 enter the following sequence:

NOUN 15 ENTER  
00000 ENTER ENTER (Press ENTER pushbutton twice)  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
14000 ENTER ENTER  
Verify R1 = 14000  
00000 ENTER (Once)  
Verify R1 = 00403

6.3.12.3.7 Start analog recorders using a chart speed of 10 mm/sec. (MG - 135° TORQUE)

6.3.12.3.8 On K-148 enter the following sequence:

VERB 42 ENTER  
VERB 33 ENTER

6.3.12.3.9 Monitor analog recorder. When MG Torque Motor Current (GG 2140) drops to a quiescent level (approximately 6 minutes), stop the recorders.

6.3.12.3.10 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTER Wait 3 seconds  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
-06750 ENTER

6.3.12.3.11 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = -06750±00200.

6.3.12.3.12 After 10 seconds has elapsed since step 6.3.12.3.10, enter the following sequence into K-148:

VERB 21 NOUN 01 ENTER  
00403 ENTER  
00000 ENTER

6.3.12.3.13 On the CRT, DSKY display verify:

VERB 21 NOUN 01  
R1 = 00000  
R3 = 00403

6.3.12.3.14 On K-148 enter the following sequence:

NOUN 15 ENTER  
00000 ENTER ENTER (Press ENTER pushbutton twice)  
Verify RI = 00000  
00000 ENTER ENTER  
Verify RI = 00000  
00000 ENTER ENTER  
Verify RI = 00000  
63777 ENTER ENTER  
Verify RI = 63777  
77777 ENTER (once)  
Verify RI = 77777

6.3.12.3.15 Start analog recorders using a chart speed of 10 mm/sec. (MG +135° TORQUE)

6.3.12.3.16 On K-148 enter the following sequence:

VERB 42 ENTER  
VERB 33 ENTER

6.3.12.3.17 Monitor analog recorder. When the MG Torque Motor Current signal (OG 2140) drops to a quiescent level (approximately 6 minutes) stop the recorders.

6.3.12.3.18 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER  
Wait 15 seconds  
VERB 36 ENTER

6.3.12.4 Test Analysis.

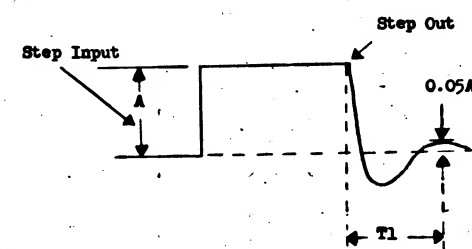
6.3.12.4.1 Remove the strip charts from analog recorders.

6.3.12.4.2 Examine each trace carefully to detect any sharp discontinuities of the traces. Disregard all transients less than 0.5 second (5 mm) on any Torque Motor Current signal. Disregard all transients less than 0.2 second (2 mm) on any CDU Fine Error signal.

6.3.12.4.3 No Torque Motor Current signal on (OG 2140, OG 2170, OG 2110) shall ever exceed (0.125) amp. Sensitivity on recorder is 20 ma/division.

6.3.12.4.4 No CDU Fine Error on (OG 2220, OG 2280, OG 2250) shall ever exceed (.070) volts. Sensitivity on recorder is 50 mv/division.

- 6.3.13 Stabilization Loop Step Response Test
- 6.3.13.1 IG Response Test
- 6.3.13.1.1 On K-148 enter the following sequence:
- VERB 40 NOUN 20 ENTER Wait 3 seconds  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER
- 6.3.13.1.2 On CRT, verify IG MD, and GG gimbal angles are between 358 and 002.
- 6.3.13.1.3 Set up analog recorder to monitor the following:
- | MEAS. NO.  | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2110 | IG Torque Motor Current |
| b. GG 2106 | IG Servo Error Total    |
| c. GG 2107 | IG Servo Error In Phase |
| d. GG 2112 | IG 1X Resolver Sine     |
| e. GG 2113 | IG 1X Resolver Cosine   |
| f. GG 2220 | IG CDU Fine Error       |
| g. GG 1201 | IMU 20V 1 PCT 800 CPS   |
- 6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:
- VERB 42 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER
- 6.3.13.1.5 On the CRT verify CDU X, CDU Y and CDU Z indicate +00000±00200.
- CAUTION:** If the transients caused by the subsequent step input do not damp out within 15 seconds, remove IMU Operate Power.
- 6.3.13.1.6 Enter 1000 into R-START 155.
- 6.3.13.1.7 Press XEQ/SEAL pushbutton on R-155 to enter the EC step voltage into the IG stabilization loop.
- 6.3.13.1.8 Prepare to start analog recorder at a chart speed of 100 mm/sec. (IG RESPONSE TEST).
- 6.3.13.1.9 Enter 0000 into R-START 155. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the IG stabilization loop.
- 6.3.13.1.10 After the transient on the recorder has died out, stop the recorder.



TYPICAL STAB. LOOP RESPONSE TO STEP INPUT

FIGURE 3.



6.3.13.1.11 From the Servo Error In Phase signal recorder trace measure the time interval (T<sub>1</sub>, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period T<sub>1</sub> shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.

#### 6.3.13.2 MG Response Test

6.3.13.2.1 Set up analog recorder to monitor the following:

| MEAS NO.   | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2136 | MG Servo Error Total    |
| b. GG 2137 | MG Servo Error In Phase |
| c. GG 2140 | MG Torque Motor Current |
| d. GG 2143 | MG LX Resolver Cosine   |
| e. GG 2250 | MG CDU Fine Error       |
| f. GG 2142 | MG LX Resolver Sine     |
| g. GG 1201 | IMU 28V 1% 800 cps      |

6.3.13.2.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (+00200).

**CAUTION:** If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate Power.

6.3.13.2.3 Enter 0100 into R-START 155. Press XEQ/SEAL pushbutton R-155 to enter the DC step voltage into the MG stabilization loop.

6.3.13.2.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (MG RESPONSE TEST).

6.3.13.2.5 Enter 0000 into R-START 155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.

6.3.13.2.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.2.7 From the Servo Error In Phase signal recorder trace measure the time interval (T<sub>1</sub>, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period, T<sub>1</sub>, shall not exceed 0.1 seconds and the trace shall have no more than 3 overshoots.

6.3.13.3 OG Response Test

6.3.13.3.1 Set up analog recorder to monitor the following:

| MEAS NO.   | SIGNAL NAME             |
|------------|-------------------------|
| a. OG 2167 | OG Servo Error In Phase |
| b. OG 2170 | OG Torque Motor Current |
| c. OG 2166 | OG Servo Error Total    |
| d. OG 2280 | OG CDU Fine Error       |
| e. OG 2172 | OG LX Resolver Sine     |
| f. OG 2173 | OG LX Resolver Cosine   |
| g. OG 1201 | IMU 28V 14 800 cps      |

6.3.13.3.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000(±00200).

**CAUTION:** If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU operate power.

6.3.13.3.3 Enter 0010 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the EC step voltage into the OG stabilization loop.

6.3.13.3.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (OG RESPONSE TEST).

6.3.13.3.5 Enter 0000 into R-155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the OG stabilization loop.

6.3.13.3.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.3.7 From the Servo Error In Phase signal recorder trace, measure the time interval (T<sub>1</sub>, Fig 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period, T<sub>1</sub>, shall not exceed 0.1 second and the trace shall have not more than 3 overshoots.

6.3.13.3.8 On K-148 enter the following sequence:

```

VERB #1 NOUN 20 ENTER
+00000 ENTER
+00000 ENTER
+00000 ENTER

```

6.3.14 G&N Fine Alignment Test

NOTE: The Fine Alignment test results are PIPA bias corrected. It is possible for a considerable time lag to occur between PIPA bias calculations in section 6.3.9 of this specification and performance of the Fine Alignment test. The applicable portions of section 6.3.9 should be performed and the PIPA bias terms recalculated if it is deemed necessary for the proper evaluation of the Fine Alignment Test results.

6.3.14.1 On K-148 enter:

VERB 01 NOUN 10 ENTR  
00003 ENTR

6.3.14.2 Record CRT, DSKY Row 1 display as AAAAA and the time of day.

6.3.14.3 On K-148 enter:

VERB 21 NOUN 01 ENTR  
03377 ENTR  
AAAAA ENTR  
VERB 06 NOUN 02 ENTR  
03377 ENTR

6.3.14.4 Record CRT DSKY Row 1, display as +BBBBB.

6.3.14.5 Perform the following calculations:

- $\frac{BBBBBX \ 5.12}{3600} = CCCC.C$  Contents of high order scalar register in hours.
- $23.3 - CCCC.C = DDDD.D$  Time left in high order scalar register until overflow.
- $DDDD.D + \text{time of day recorded in step 3} = \text{time of day at which high order scalar register will overflow.}$

6.3.14.6 If the time of day is within 12 minutes of that time calculated in 6.3.14.5.c when about to complete step 6.3.14.30 wait until that time calculated in c has passed and then proceed.

NOTE: Use of Dioptrimeter is required for all optical sightings using AOT.

6.3.14.7 On K-148 enter:

VERB 01 NOUN 01 ENTR  
00366 ENTR  
Record contents of Row 1 XXXXY  
VERB 21 NOUN 01 ENTR  
00366 ENTR  
XXXXY' ENTR  
Where Y' is obtained from Table II.  
VERB 57 ENTR  
00003 ENTR

6.3.14.8      Verify CRT DSKY display as:  
VERB 06 NOUN 61 (Flashing)  
R1 = +13500      (SM Azimuth)  
R2 = -28.156      (Site Latitude)  
  
NOTE: If R1 and R2 indications are correct proceed to step 6.3.14.10.

6.3.14.9      On K-148 enter:  
VERB 21 ENTR  
+13500 ENTR  
VERB 22 ENTR  
-28.156 ENTR

6.3.14.10      On K-148 enter:  
VERB 33 ENTR  
Observe on CRT DSKY display  
VERB 21 NOUN 30 (Flashing)

6.3.14.11      On K-148 enter:  
0000X ENTR (Test position, either 1 or 2)  
00000 ENTR (Use AOT)  
Observe on CRT DSKY display:  
VERB 06 NOUN 61 (Flashing)  
Disregard Row 1, 2, and 3 indications.

6.3.14.12      On K-148 enter:  
VERB 21 ENTR  
+XXX.XX ENTR (L tgt. true azimuth from 6.3.15.1.14)  
VERB 22 ENTR  
+XXX.XX ENTR (L tgt. elevation from 6.3.15.1.3)  
VERB 23 ENTR  
00001 ENTR (L tgt. number)  
VERB 33 ENTR  
  
Observe on CRT DSKY display:  
VERB 06 NOUN 61 (Flashing)  
  
Disregard Row 1, 2, and 3 indications.

6.3.14.13      On K-148 enter:  
VERB 21 ENTR  
+XXX.XX ENTR (F tgt. true azimuth from 6.3.15.1.14)  
VERB 22 ENTR  
+XXX.XX ENTR (F tgt. elevation from 6.3.15.1.12)  
VERB 23 ENTR  
00002 ENTR (F tgt. number)  
VERB 33 ENTR  
  
Observe on CRT DSKY display  
VERB 51 (flashing)  
R1 = 00001

- 6.3.14.14 On Computer Control and Reticule Dimmer Assembly, press MARK X push-button. Observe on DSKY display:  
VERB 21 NOUN 30 (Flashing)
- 6.3.14.15 On DSKY press ENTR.  
Observe on DSKY display:  
VERB 21 NOUN 43 (Flashing)
- 6.3.14.16 On DSKY enter:  
00001 ENTR (L Detent Code)  
Observe on DSKY display  
VERB 21 NOUN 42 (Flashing)
- 6.3.14.17 Set AOT to "L" position.
- 6.3.14.18 Rotate AOT control knob until the center of the L tgt. reticle is superimposed between the double Y reticles. Record AOT counter value as LY XXX.XX.
- 6.3.14.19 Rotate AOT control knob until the center of the L tgt. reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as LS XXX.XX.
- 6.3.14.20 On DSKY enter:  
±XXX.XX ENTR (value of LY)  
Observe on DSKY display:  
VERB 22 NOUN 42 (Flashing)
- 6.3.14.21 On DSKY enter:  
±XXX.XX ENTR (Value of LS)  
Observe on DSKY display:  
VERB 51 (Flashing)  
R1 = 00002
- 6.3.14.22 On Computer Control and Reticule Dimmer Assembly, press MARK X push-button. Observe on DSKY display:  
VERB 21 NOUN 30 (Flashing)
- 6.3.14.23 On DSKY press ENTR. Observe on DSKY display:  
VERB 21 NOUN 43 (Flashing)
- 6.3.14.24 On DSKY enter:  
00002 ENTR (F Detent Code)  
Observe on DSKY display:  
VERB 21 NOUN 42 (Flashing)

- 6.3.14.35 In approximately 7 minutes, observe on CRT DSKY display and record.
- VERB 06 NOUN 66 (Flashing)  
R1 = XXXXX (Whole number part of Xsm misalignment about Ysm)  
R2 = .XXXXX (Fractional number part of Xsm misalignment about Ysm)
- 6.3.14.36 On K-148 enter:
- VERB 33 ENTR  
Observe on CRT DSKY display and record:  
VERB 06 NOUN 66 (Flashing)  
R1 = XXXXX (Whole number part of Ysm misalignment about Xsm)  
R2 = .XXXXX (Fractional number part of Ysm misalignment about Xsm)
- 6.3.14.37 On K-148 enter:
- VERB 36 ENTR  
Press ERROR RESET  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.3.14.38 Results. The FIPA bias determined previously in the IMU Performance Test (6.3.9) must be subtracted from the resultant data of the test.
- 6.3.14.38.1 Y FIPA misalignment
- |                                            | R1    | R2        |
|--------------------------------------------|-------|-----------|
| About Z axis (from 6.3.14.31) = ±XXXXX.    | XXXXX | XXXXX sec |
| Less Y FIPA bias (from 6.3.9) = -(±XXXXX). | XXXXX | XXXXX sec |
| Y FIPA misalignment about Z axis = ±-----. |       | ----- sec |
| This value shall not exceed 255 sec        |       |           |
- 6.3.14.38.2 Z FIPA misalignment
- |                                            | R1    | R2        |
|--------------------------------------------|-------|-----------|
| About Y axis (from 6.3.14.32) = ±XXXXX.    | XXXXX | XXXXX sec |
| Less Z FIPA bias (from 6.3.9) = -(±XXXXX). | XXXXX | XXXXX sec |
| Z FIPA misalignment about Y axis = ±-----. |       | ----- sec |
| This value shall not exceed 255 sec        |       |           |
- 6.3.14.38.3 X FIPA misalignment
- |                                            | R1    | R2        |
|--------------------------------------------|-------|-----------|
| About Y axis (from 6.3.14.35) = ±XXXXX.    | XXXXX | XXXXX sec |
| Less X FIPA bias from (6.3.9) = -(±XXXXX). | XXXXX | XXXXX sec |
| X FIPA misalignment about Y axis = ±-----. |       | ----- sec |
| This value shall not exceed 255 sec        |       |           |
- 6.3.14.38.4 Y FIPA misalignment
- |                                            | R1    | R2        |
|--------------------------------------------|-------|-----------|
| About X axis from (6.3.14.36) = ±XXXXX.    | XXXXX | XXXXX sec |
| Less Y FIPA bias (from 6.3.9) = -(±XXXXX). | XXXXX | XXXXX sec |
| Y FIPA misalignment about X axis = ±-----. |       | ----- sec |
| This value shall not exceed 255 sec        |       |           |

- 6.3.15 AOT Functional Accuracy Test
- NOTE: Use of a Dioptrimeter is required when sighting through AOT.
- 6.3.15.1 Determination of Detent Angle Reference.
- NOTE: The included angles between targets LOS shall be known to  $\pm 10$  arc seconds. The elevation of each target LOS shall be known to  $\pm 15$  arc seconds.
- 6.3.15.1.1 Place AOT in L detent position.
- NOTE: Communication between AOT and target theodolite operators is required.
- 6.3.15.1.2 While viewing through AOT, instruct the target L operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target L, until the target reticle appears in the lower right quadrant of the AOT field of view.
- NOTE: The target theodolite base must be level when alignment is achieved.
- 6.3.15.1.3 Upon alignment, zero the azimuth dial and record the elevation indication of target L as  $\theta_1$ .
- 6.3.15.1.4 Place AOT in R detent position.
- 6.3.15.1.5 While viewing through AOT, instruct the target R operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target R, until the target reticle appears in the lower left quadrant of the AOT field of view.
- 6.3.15.1.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record the target R elevation dial indication, as  $\theta_2$ . Zero the target R azimuth dial. Record AOT dial indication as  $\theta_3 = XXX.XX$ .
- 6.3.15.1.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT dial indication as  $\theta_4 = XXX.XX$ .
- 6.3.15.1.8 Collimate L and R targets on each other, record each target azimuth with each target LOS leveled.
- Target L as  $\alpha_1$ , Target R as  $\alpha_2$
- 6.3.15.1.9 Place the AOT in F detent position.

- 6.3.15.1.10 Move the R target theodolite to a position in front of the AOT F detent position. (The target shall now be referred to as the F target).
- 6.3.15.1.11 While viewing through the AOT, instruct the target F operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target reticle appears in the center of the AOT reticle.
- 6.3.15.1.12 Upon alignment, zero the azimuth dial and record the elevation indication of target F as  $\beta_2$ .
- 6.3.15.1.13 Collimate L and F targets on each other, record each target azimuth with each target LOS leveled. Target F az =  $\alpha_2$ .
- 6.3.15.1.14 Determine the true azimuth of targets L and F with respect to the AOT. The target azimuth shall be known to within 0.5 arc degrees.
- 6.3.15.1.15 Rotate the F target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.12.
- 6.3.15.1.16 Rotate the L target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.13.
- 6.3.15.1.17 Calculate the values of the included angles between target L and F as  $X_1$  and targets L and R as  $X_2$ .
- $$X_1 = \cos^{-1} \{ \sin \beta_1 \sin \beta_2 + \cos \beta_1 \cos \beta_2 \cos [180 - (\alpha_1 + \alpha_2)] \}$$
- $$X_2 = \cos^{-1} \{ \sin \beta_1 \sin \beta_3 + \cos \beta_1 \cos \beta_3 \cos [180 - (\alpha_3 + \alpha_1)] \}$$
- Where:  $\alpha_1$  = as value, step 6.3.15.1.8  
 $\alpha_2$  = as value, step 6.3.15.1.13  
 $\alpha_3$  = as value, step 6.3.15.1.8

## 6.3.15.2 Computer Loading of Detent Calibration Data

## 6.3.15.2.1 On K-148 enter:

|         |         |                          |
|---------|---------|--------------------------|
| VERB 21 | NOUW 03 | ENTER                    |
| 01467   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent L AZ data) |
|         |         | ENTER                    |
| 01470   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent F AZ data) |
|         |         | ENTER                    |
| 01471   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent R AZ data) |
|         |         | ENTER                    |
| 01472   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent L EL data) |
|         |         | ENTER                    |
| 01473   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent F EL data) |
|         |         | ENTER                    |



- 6.3.15.2.1 (cont)
- 1474 ENTER  
XXX.XX ENTER (Detent R EL data)
- 6.3.15.3 AOT Measurement of  $X_1$
- 6.3.15.3.1 On K-148 enter:
- VERB 57 ENTER  
00012 ENTER  
Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display.
- 6.3.15.3.2 On Computer Control and Reticle Dimming Assembly press MARK X pushbutton. Observe VERB 50 displayed on CRT DSKY display.
- 6.3.15.3.3 On DSKY press ENTER
- Observe VERB 21 NOUN 30 flashing on DSKY
- 6.3.15.3.4 On DSKY enter:
- 00000 ENTER  
Observe VERB 21 NOUN 43 flashing  
00001 ENTER  
Observe VERB 21 NOUN 42 flashing
- 6.3.15.3.5 Set AOT in L detent position.
- 6.3.15.3.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record LY = XXX.XX.
- 6.3.15.3.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT Dial indication as LS XXX.XX.
- 6.3.15.3.8 On DSKY enter:
- \*XXX.XX ENTER (LY from 6.3.15.3.6)  
Observe VERB 22 NOUN 42 flashing  
\*XXX.XX ENTER (LS from 6.3.15.3.7)  
Observe VERB 51 flashing and R1 = 00002.
- 6.3.15.3.9 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed.
- 6.3.15.3.10 On DSKY press ENTER
- Observe VERB 21, NOUN 30 flashing on DSKY.

6.3.15.3.11 On DSKY enter:

00000 ENTR  
Observe VERB 21, NOUN 43 flashing  
00002 ENTR  
Observe VERB 21, NOUN 42 flashing

6.3.15.3.12 Set AOT in F detent position.

6.3.15.3.13 Rotate AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Record AOT dial indication as FY = XXX.XX.

6.3.15.3.14 Rotate the AOT control knob until the center of the target reticle is superimposed between the double S reticle lines. Record AOT dial indications as FS = XXX.XX.

6.3.15.3.15 On DSKY enter:

±XXX.XX ENTR (FY from 6.3.15.3.13)  
Observe VERB 22 NOUN 42 flashing  
±XXX.XX ENTR (FS from 6.3.15.3.14)  
Observe VERB 06 NOUN 03, R1 =  $X1 \pm 0.08$  degrees.

6.3.15.4 AOT Measurement of X2

6.3.15.4.1 On K-148 enter

VERB 57 ENTR  
00012 ENTR  
Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display.

6.3.15.4.2 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed on CRT DSKY display.

6.3.15.4.3 On DSKY press ENTR. Observe VERB 21 NOUN 30 flashing on DSKY.

6.3.15.4.4 On DSKY enter:

00000 ENTR  
Observe VERB 21 NOUN 43 flashing  
00001 ENTR  
Observe VERB 21 NOUN 42 flashing  
±XXX.XX ENTR (LY from 6.3.15.3.6)  
Observe VERB 22 NOUN 42 flashing  
±XXX.XX ENTR (LS from 6.3.15.3.7)  
Observe VERB 51 flashing and R1 = 00002.

- 6.3.15.4.5 On Computer Control and Reticule Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed.
- 6.3.15.4.6 On DSKY press ENTR. Observe VERB 21, NOUN 30 flashing on DSKY.
- 6.3.15.4.7 On DSKY enter:
- 00000 ENTR  
Observe VERB 21 NOUN 43 flashing  
00002 ENTR  
Observe VERB 21 NOUN 42 flashing  
±XXX.XX ENTR (RY from 6.3.15.1.6)  
Observe VERB 22 NOUN 42 flashing  
±XXX.XX ENTR (RS from 6.3.15.1.7)  
Observe VERB 06 NOUN 03, R1 = X2±0.08 degrees.
- 6.3.16 Flight Role Fixed Memory Bank Sum Check
- NOTE: Before proceeding with this test, obtain a Computer Program listing of the flight program being tested. Prepare a list of the bank CKSM bugger words.
- 6.3.16.1 Verify G&N system in Standby Mode.
- 6.3.16.2 On K-148 enter the following sequence:
- Press ERR RST  
VERB 56 ENTR  
Observe VERB 05 NOUN 01 flashing
- 6.3.16.3 Record the CRT DSKY display indications.
- Row 1 = AAAAA Bank Sum  
Row 2 = 000BB Bank Number  
Row 3 = CCCCC (Bank CKSM bugger word)
- Row 1 shall be the same as or the complement of the number displayed in Row 2. Row 3 indication shall be the same as the bugger word recorded above for the bank tested.
- 6.3.16.4 On K-148 enter VERB 33 ENTR
- 6.3.16.5 Repeat paragraphs 6.3.16.3 and 6.3.16.4 until all memory bank sums have been checked.
- 6.3.16.6 On K-148 enter VERB 34 ENTR.

- 6.3.17 LSC Clock Alignment Test
- 6.3.17.1 Verify the following CRT indications:
- ACCEPT UPLINK - ON  
UP LOCK - OFF  
OP ERROR - OFF
- 6.3.17.2 Set R144 to 00001 and execute observe that CRT indicates TIME ERROR as blank.
- 6.3.17.3 Set 70 00024 020 into C156 to insert K-FACT Execute.
- 6.3.17.4 Set 71 00000 000 into C156 to insert TEPOCH. Execute.
- 6.3.17.5 Obtain Range Time in Hours, Minutes, and Seconds.
- 6.3.17.6 Add 5 minutes to Range time and insert 90 XX (HRS) XX (MIN's) XX (SEC's) into C156. Execute
- 6.3.17.7 Set 91 + 00000 00 into C156 to insert AGC RESET time. Execute.
- 6.3.17.8 Before Range Time +5 minutes occurs, set 0001 into R152. Execute.
- 6.3.17.9 Verify that CRT indication of TIME ERROR is blank.
- NOTE: If TIME ERROR 1 is present, repeat all preceding steps of LSC Clock Alignment.
- 6.3.17.10 Set R152 to 0000. Execute.
- 6.3.17.11 Set R152 to 0010. Execute. Record CRT indication of DELTA TIME. Verify that CRT indication of TIME ERROR is blank.
- 6.3.17.12 Set R152 to 0000. Execute.
- 6.3.17.13 Set R152 to 0100. Execute. Verify that CRT indication of TIME ERROR is blank.
- 6.3.17.14 Set R152 to 0000. Execute.
- 6.3.17.15 Set R152 to 0010. Execute. Record CRT indication of DELTA TIME. DELTA TIME shall be 00(HRS), 00(MIN's) 000.000(SEC's)  $\pm 0.01$  SEC.
- 6.3.17.16 Set R152 to 0000. Execute.

APPENDIX I  
MEASUREMENT TOLERANCES

| SIGNAL           | SIGNAL NAME                  | G&N LAB TEST REQUIREMENT                 | PSAAM AND/OR SCA UNCERTAINTY % OF FULL SCALE |
|------------------|------------------------------|------------------------------------------|----------------------------------------------|
| GG 1020 link 4*  | +14 vdc LGC Supply           | 14.0±0.4 vdc                             | 0%                                           |
| GG 1030 link 4   | +4 vdc LGC Supply            | 4.0±0.2 vdc                              | 0%                                           |
| CG 1040 link 5** | +120 vdc WIPA Supply         | 120±6.0 vdc                              | 1%                                           |
| GG 1070 link 4   | +4 vdc CDU Supply            | 4.0±0.2 vdc                              | 0%                                           |
| GG 1100 link 4   | -28 vdc Supply               | -27.5±6.0 vdc                            | 0%                                           |
| GG 1110 link 5   | 2.5 vdc Telemetry Bias No. 1 | 2.5±0.1 vdc                              | 0%                                           |
| GG 1201 link 5   | IMU 28V 800 cps 1%           | 28±0.56V rms                             | 1%                                           |
| GG 1202 link 4   | IMU 28V 800 cps 5%           | 28±1.4V rms                              | 1.5%                                         |
| GG 1203 link 4   | IMU 28V 800 cps 5%           | 28±2.1V rms                              | 1.5%                                         |
| GG 1331 link 5   | 3.2 kc 28V Supply 1%         | 28.6±0.56V rms                           | 1%                                           |
| GG 1500 link 4   | +28 vdc IMU Oper BUS         | 28.0-3.5, +5.5 vdc                       | 0%                                           |
| GG 1510 link 4   | +28 vdc IMU STBY BUS         | 28.0-3.5, +5.5 vdc                       | 0%                                           |
| GG 1513X link 5  | +28 vdc IMU STBY/OFF         | 28.0±1 vdc                               | 0%                                           |
| GG 1520 link 4   | +28 vdc LGC Oper BUS         | 28.0 + 4.5, -3.5 vdc                     | 0%                                           |
| GG 1523X link 5  | +28 vdc LGC Operate          | 28.0±1 vdc                               | 0%                                           |
| GG 2001 link 5   | X PIPA S.G. OUT IN PH        | +2.5±0.128V rms at 1g                    | 3%                                           |
| GG 2021 link 5   | Y PIPA S.G. OUT IN PH        | +2.5±0.128V rms at 1g                    | 3%                                           |
| GG 2041 link 5   | Z PIPA S.G. OUT IN PH        | +2.5±0.128V rms at 1g                    | 3%                                           |
| GG 2106 link 4   | IG Servo Error Total         | 0.0±60 MV rms at null                    | 1%                                           |
| GG 2107 link 5   | IG Servo Error IN PH         | 0.0±60 MV rms at null                    | 2%                                           |
| GG 2110 link 4   | IG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 0%                                           |
| GG 2110 link 5   | IG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 1%                                           |
| GG 2112 link 5   | IG 1X Resolver Out-Sine      | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2113 link 5   | IG 1X Resolver Out-Cosine    | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2121 link 5   | IG 1X Resolver Out-Sine 11°  | 5.35±0.27V rms at 11°                    | 2%                                           |
| GG 2136 link 4   | MG Servo Error Total         | 0.0±60 MV rms at null                    | 1%                                           |
| GG 2137 link 5   | MG Servo Error IN PH         | 0.0±60 MV rms at null                    | 2%                                           |
| GG 2140 link 4   | MG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 0%                                           |
| GG 2140 link 5   | MG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 1%                                           |
| GG 2142 link 5   | MG 1X Resolver Out-Sine      | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2143 link 5   | MG 1X Resolver Out-Cosine    | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2151 link 5   | MG 1X Resolver Out-Sine 11°  | 5.35±0.27V rms at 11°                    | 2%                                           |
| GG 2166 link 4   | OG Servo Error Total         | 0.0±60 MV rms at null                    | 1%                                           |
| GG 2167 link 5   | OG Servo Error IN PH         | 0.0±60 MV rms at null                    | 2%                                           |
| GG 2170 link 4   | OG Torque Motor Current      | 0.9 AMP Max during any fine Align Torque | 0%                                           |
| GG 2170 link 5   | OG Torque Motor Current      | 0.9 AMP Max during any fine Align Torque | 1%                                           |
| GG 2172 link 5   | OG 1X Resolver Out-Sine      | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2173 link 5   | OG 1X Resolver Out-Cosine    | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2181 link 5   | OG 1X Resolver Out-Sine 11°  | 5.35±0.27V rms at 11°                    | 2%                                           |
| GG 2219 link 5   | Pitch Attitude Error         | 5.05±0.5V rms at 17°                     | 1%                                           |
| GG 2220 link 4   | IG CDU Fine Error            | 0.0±0.07V rms at null                    | 1%                                           |
| GG 2221 link 4   | IG CDU Coarse Error          | 0.0±0.68V rms at null                    | 1%                                           |

APPENDIX I (Continued)

| SIGNAL         | SIGNAL NAME                         | G&N LAB TEST REQUIREMENT  | PSAAM AND/OR SCA UNCERTAINTY % OF FULL SCALE |
|----------------|-------------------------------------|---------------------------|----------------------------------------------|
| OG 2249 link 5 | YAW Attitude Error                  | 5.05±0.5V rms at 17°      | 1%                                           |
| OG 2250 link 4 | MG CDU Fine Error                   | 0.0±0.07V rms at null     | 1%                                           |
| OG 2251 link 4 | MG CDU Coarse Error                 | 0.0±0.68V rms at null     | 1%                                           |
| OG 2279 link 5 | Roll Attitude Error                 | 5.05±0.5V rms at 17°      | 1%                                           |
| OG 2280 link 4 | OG CDU Fine Error                   | 0.0±0.07V rms at null     | 1%                                           |
| OG 2281 link 4 | OG CDU Coarse Error                 | 0.0±0.68V rms at null     | 1%                                           |
| OG 2300 link 5 | PIPA Temperature                    | 130.5° ± 1.5°F in Operate | 1%                                           |
| OG 2301 link 4 | IRIG Temperature                    | 135° ± 2.5°F in Operate   | 1%                                           |
| OG 2301 link 5 | IRIG Temperature                    | 135° ± 2.5°F in Operate   | 1%                                           |
| OG 2302 link 4 | IMU Heater Current On               | 28±1 vdc                  | 0%                                           |
| OG 2303 link 4 | IMU Blower Current On               | 28±1 vdc                  | 0%                                           |
| OG 3304 link 5 | RR Shaft 1X Resolver Out-Sine       | 19.65±0.98V rms at 45°    | 2.5%                                         |
| OG 3305 link 5 | RR Shaft 1X Resolver Out-Cosine     | 19.65±0.98V rms at 45°    | 2.5%                                         |
| OG 3311 link 4 | RR Shaft CDU Fine Error             | 0.0±0.07V rms at null     | 1%                                           |
| OG 3312 link 4 | RR Shaft CDU Coarse Error           | 0.0±0.68V rms at null     | 1%                                           |
| OG 3321 link 4 | RR Trunnion CDU Fine Error          | 0.0±0.07V rms at null     | 1%                                           |
| OG 3322 link 4 | RR Trunnion CDU Coarse Error        | 0.0±0.68V rms at null     | 1%                                           |
| OG 3324 link 5 | RR Trunnion 1X Resolver Out-Sine    | 19.65±0.98V rms at 45°    | 2.5%                                         |
| OG 3325 link 5 | RR Trunnion 1X Resolver Out-Cosine  | 19.65±0.98V rms at 45°    | 2.5%                                         |
| OG 4300 link 4 | LGC Temperature                     | 87.5±2.5°F                | 0%                                           |
| OG 6020 link 4 | PIPA Calibration Module Temperature | 67.5±22.5°F               | 0%                                           |
| OG 6020 link 5 | PIPA Calibration Module Temperature | 67.5±22.5°F               | 0%                                           |
| OG 6021 link 4 | PSA Temperature                     | 85±25.0°F                 | 0%                                           |
| NG 1336 link 4 | PHDIFF 3.2KC 28V/LGC SYNC           | 0° ±10°                   | 3%                                           |

\* Link 4 - PSAAM Output Signal  
\*\* Link 5 - SCA Output Signal

## ADDENDUM I

## LEM 1

ADDITION 1: The following procedure will be performed for LEM 1 only.

6.3.18 Gyrocompassing Test

6.3.18.1 Inertial Instrument Calibration data Load.

6.3.18.1.1 On K-148 enter:

|         |               |       |
|---------|---------------|-------|
| VERB 21 | MOUW 01       | ENTER |
| 01436   |               | ENTER |
| XXXXX   | (X PIPA BIAS) | ENTER |
|         |               | ENTER |
| 01437   |               | ENTER |
| XXXXX   | (X PIPA S.F.) | ENTER |
|         |               | ENTER |
| 01440   |               | ENTER |
| XXXXX   | (Y PIPA BIAS) | ENTER |
|         |               | ENTER |
| 01441   |               | ENTER |
| XXXXX   | (Y PIPA S.F.) | ENTER |
|         |               | ENTER |
| 01442   |               | ENTER |
| XXXXX   | (Z PIPA BIAS) | ENTER |
|         |               | ENTER |
| 01443   |               | ENTER |
| XXXXX   | (Z PIPA S.F.) | ENTER |
|         |               | ENTER |
| 01444   |               | ENTER |
| XXXXX   | (WBIX)        | ENTER |
|         |               | ENTER |
| 01445   |               | ENTER |
| XXXXX   | (WBDY)        | ENTER |
|         |               | ENTER |
| 01446   |               | ENTER |
| XXXXX   | (WBIZ)        | ENTER |
|         |               | ENTER |
| 01447   |               | ENTER |
| XXXXX   | (ADIX)        | ENTER |
|         |               | ENTER |
| 01450   |               | ENTER |
| XXXXX   | (ADIX)        | ENTER |
|         |               | ENTER |
| 01451   |               | ENTER |
| XXXXX   | (ADIZ)        | ENTER |
|         |               | ENTER |
| 01452   |               | ENTER |
| XXXXX   | (ADIRAX)      | ENTER |
|         |               | ENTER |

## 6.3.18.1.1 (cont)

|       |          |       |
|-------|----------|-------|
| 01453 |          | ENTER |
| XXXXX | (ADBRAY) | ENTER |
| 01454 |          | ENTER |
| XXXXX | (ADBRAX) | ENTER |

## 6.3.18.2 Non-Standard Gyrocompassing Position Vector Load.

## 6.3.18.2.1 On K-148 enter:

|         |         |       |
|---------|---------|-------|
| VERB 21 | MOON 01 | ENTER |
| 02720   |         | ENTER |
| 15666   |         | ENTER |
| 02721   |         | ENTER |
| 17272   |         | ENTER |
| 02722   |         | ENTER |
| 73605   |         | ENTER |
| 02723   |         | ENTER |
| 56927   |         | ENTER |
| 02724   |         | ENTER |
| 71156   |         | ENTER |
| 02725   |         | ENTER |
| 54909   |         | ENTER |
| 02726   |         | ENTER |
| 10000   |         | ENTER |
| 02727   |         | ENTER |
| 00000   |         | ENTER |
| 02730   |         | ENTER |
| 07257   |         | ENTER |
| 02731   |         | ENTER |
| 20033   |         | ENTER |
| 02732   |         | ENTER |
| 13600   |         | ENTER |
| 02733   |         | ENTER |
| 16506   |         | ENTER |
| 02734   |         | ENTER |
| 00000   |         | ENTER |
| 02735   |         | ENTER |
| 00000   |         | ENTER |
| 02736   |         | ENTER |
| 82334   |         | ENTER |



6.3.18.2.1 (cont)

|       |       |
|-------|-------|
| 02737 | ENTER |
| 71218 | ENTER |
| 02740 | ENTER |
| 10385 | ENTER |
| 02741 | ENTER |
| 03117 | ENTER |

6.3.18.3 Gyrocompassing

6.3.18.3.1 On K-148 enter

|         |       |
|---------|-------|
| VERB 57 | ENTER |
| 00007   | ENTER |

6.3.18.3.2 VERB 06 NOUN 51 shall flash

6.3.18.3.3 The CRT DSKY shall display Nav Base Azimuth in Row 1 and site latitude in Row 2.

6.3.18.3.4 If the display in Row 1 and Row 2 is correct proceed to the next step. If value for Row 1 or Row 2 is incorrect enter the following into K-148.

|         |       |                          |
|---------|-------|--------------------------|
| VERB 21 | ENTER |                          |
| +XXXXX  | ENTER | Correct Nav Base Azimuth |
| VERB 22 | ENTER |                          |
| +28.516 | ENTER |                          |

6.3.18.3.5 In K-148 enter:

|         |       |
|---------|-------|
| VERB 33 | ENTER |
|---------|-------|

6.3.18.3.6 VERB 06 NOUN 66 shall flash.

6.3.18.3.7 The CRT DSKY shall display +00120 in Row 1 and Row 3 shall display +00011. If the display is correct proceed to the next step. If the display is incorrect enter the following into K-148:

|         |       |
|---------|-------|
| VERB 21 | ENTER |
| +00120  | ENTER |
| VERB 23 | ENTER |
| +00011  | ENTER |

6.3.18.3.8 On K-148 enter:

|                 |       |
|-----------------|-------|
| VERB 33         | ENTER |
| VERB 16 NOUN 20 | ENTER |

6.3.18.3.9 One hour after step 6.3.18.3.8 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.18.3.10 The Row 1 indication shall be within  $\pm 000.57$  degrees of desired launch azimuth.

6.3.18.3.11 Row 2 shall indicate  $000.00 \pm 000.06$  degrees and Row 3 shall indicate  $030.00 \pm 000.06$  degrees.

6.3.18.3.12 Two hours after performing paragraph 6.3.18.3.8 record CRT DSKY display of Row 1, Row 2, and Row 3.

6.3.18.3.13 The CRT DSKY display of Row 1 shall be within  $\pm 000.06$  degrees of the value recorded in 6.3.18.3.9. The CRT DSKY display of Row 2 and Row 3 shall be within  $\pm 000.03$  degrees of the respective values recorded in 6.3.18.3.9.

6.3.18.3.14 On K-148 enter the following:

|         |         |      |
|---------|---------|------|
| VERB 36 |         | ENTR |
| VERB 40 | NOUN 20 | ENTR |
| +00000  |         | ENTR |
| +00000  |         | ENTR |
| +00000  |         | ENTR |

ADDENDUM 1

LEM 1

Addition 2: Perform LEM 1 test in accordance with the following flowgram.

Addition 3: Place a note after paragraph 6.3.1.5.2.

NOTE: Before performing the following step insure that the ATCA switch on LEM Panel 16 and the ATCA/PGNCS switch on Panel 11 are in the off position.



**FIGURE 1**

APOLLO G&N Specification  
 WD 1002349  
 Original Issue Date:  
 Release Authority: TDRR 32362  
 Class A Release

POST INSTALLATION CHECKOUT  
 SPECIFICATION FOR LEM G&N  
 SYSTEM (KSC)

Record of Revisions

| Date | Revision Letter | TDRR No. | Pages Revised |
|------|-----------------|----------|---------------|
|      |                 |          |               |
|      |                 |          |               |
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|      |                 |          |               |
|      |                 |          |               |
|      |                 |          |               |
|      |                 |          |               |
|      |                 |          |               |

This specification consists of page 1 to 75 inclusive.

|           |                                         |                               |                            |
|-----------|-----------------------------------------|-------------------------------|----------------------------|
| APPROVALS | NOT REQUIRED<br>61A497-0274<br>NASA/MSC | <i>[Signature]</i><br>12/2/66 | <i>[Signature]</i><br>ACED |
|-----------|-----------------------------------------|-------------------------------|----------------------------|

APOLLO G&N Specification  
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|      |                    |             |               |
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|      |                    |             |               |

This specification consists of page 1 to 75 inclusive.

|           |                                        |         |      |
|-----------|----------------------------------------|---------|------|
| APPROVALS | NOT REQUIRED<br>CCA4970274<br>NASA/MSC | 12/2/66 | ACED |
|-----------|----------------------------------------|---------|------|

1. INTRODUCTION

- 1.1 The individual Spacecraft (SC) installed Guidance and Navigation (G&N) System to be checked out per the process specification shall consist of one of each of the following major assemblies. Refer to drawing 6015000 for specific system dash numbers and effectivities.

| <u>Assembly Name</u>                            | <u>Part Number</u> |
|-------------------------------------------------|--------------------|
| 1 - Apollo Guidance Computer Group              | 6003001-XXX        |
| 1 - Inertial Meas. Unit & Pulse Torque Assembly | 6007001-XXX        |
| 1 - Coupling Data Unit                          | 2007222-XXX        |
| 1 - Power and Servo Assembly                    | 6007200-XXX        |
| 1 - Computer Control & Reticle Dimmer Assembly  | 6014512-XXX        |
| 1 - G&N Interconnect Harness Assembly (LEM)     | 6014515-XXX        |
| 1 - Signal Conditioner Assembly                 | 6070010-XXX        |
| 1 - Navigation Base Assembly (LEM)              | 6899950-XXX        |
| 1 - Alignment Optical Telescope (LEM)           | 6011000-XXX        |

- 1.2 The G&N System herein shall be identified by Part #6015000. The computer contains the Sunburst 38 program flight ropes in the core rope memory.

2. SCOPE

- 2.1 This specification outlines the checkout requirements for G&N System installed in a LEM VEHICLE. Addendum to this specification will cover any special checkout requirements associated with individual vehicles and G&N Systems.

3. APPLICABLE DOCUMENTS

| <u>Document Number</u> | <u>Subject</u>                                 |
|------------------------|------------------------------------------------|
| LIS-540-10001          | LEM-PGNS Functional Interface                  |
| LID-340-10000          | ICD-PGNS (LGC-CDU-PSA and Sig. Cond.) Instl.   |
| LID-340-10010          | ICD-LEM DSKY Installation                      |
| LID-280-10004          | ICD-IMU-ACT-NVB-PTA Installation               |
| LID-390-10001          | ICD-LEM Wiring Electrical Interface for PGNS   |
| LID-540-10001          | ICD-LEM-PGNS Functional Interface Flow Diagram |

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|-------------------------------------------------|-------------|
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| 1 - Inertial Meas. Unit & Pulse Torque Assembly | 6007001-XXX |
| 1 - Coupling Data Unit                          | 2007222-XXX |
| 1 - Power and Servo Assembly                    | 6007200-XXX |
| 1 - Computer Control & Reticle Dimmer Assembly  | 6014512-XXX |
| 1 - G&N Interconnect Harness Assembly (LEM)     | 6014515-XXX |
| 1 - Signal Conditioner Assembly                 | 6070010-XXX |
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| 1 - Alignment Optical Telescope (LEM)           | 6011000-XXX |

- 1.2 The G&N System herein shall be identified by Part #6015000. The computer contains the Sunburst 38 program flight ropes in the core rope memory.

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3. APPLICABLE DOCUMENTS

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|-----------------|------------------------------------------------|
| LIS-540-10001   | LEM-FGNS Functional Interface                  |
| LID-340-10000   | ICD-FGNS (LGC-CDU-PSA and Sig. Cond.) Instl.   |
| LID-340-10010   | ICD-LEM DSKY Installation                      |
| LID-280-10004   | ICD-IMU-ACT-NVB-PTA Installation               |
| LID-390-10001   | ICD-LEM Wiring Electrical Interface for FGNS   |
| LID-540-10001   | ICD-LEM-FGNS Functional Interface Flow Diagram |



| <u>Document Number</u> | <u>Subject</u>                                                       |
|------------------------|----------------------------------------------------------------------|
| LIS-510-10001          | Thermodynamic Requirements of Guidance & Navigation Equipment - GANE |
| LIS-520-10001          | LEM Design Environment                                               |
| LIS-350-10002          | LEM-FGMS Lateral and Forward Velocity Interface                      |
| LIS-370-10007          | LEM-FGMS 800 CPS Power Electrical Interface                          |
| LIS-370-10003          | LEM-FGMS Measurement Interface                                       |
| LIS-370-10004          | LEM-LGC Electrical Interface                                         |
| LIS-390-10002          | Guidance and Navigation Prime Power Requirements and Characteristics |
| LID-410-10002          | IGTC System Interface                                                |
| LID-410-10003          | PSA Adapter Module Interface                                         |

3.2 The following addendum are applicable to this document.

3.2.1 Addendum 1 LEM 1.

| <u>Document Number</u> | <u>Subject</u>                                                       |
|------------------------|----------------------------------------------------------------------|
| LIS-510-10001          | Thermodynamic Requirements of Guidance & Navigation Equipment - G&N  |
| LIS-520-10001          | LEM Design Environment                                               |
| LIS-350-10002          | LEM-PONS Lateral and Forward Velocity Interface                      |
| LIS-370-10007          | LEM-PONS 800 CPS Power Electrical Interface                          |
| LIS-370-10003          | LEM-PONS Measurement Interface                                       |
| LIS-370-10004          | LEM-LGC Electrical Interface                                         |
| LIS-390-10002          | Guidance and Navigation Prime Power Requirements and Characteristics |
| LID-410-10002          | ICTC System Interface                                                |
| LID-410-10003          | PSA Adapter Module Interface                                         |
| 3.2                    | The following addendum are applicable to this document.              |
| 3.2.1                  | Addendum 1 LEM 1.                                                    |

4. Material and Equipment

4.1 The following test equipment shall be used to demonstrate the requirements of this specification. If protection to personnel and equipment is not decreased, items except government furnished parts, equivalent to those listed may be used.

| ITEM | DESCRIPTION                                           | MODEL NO.    |
|------|-------------------------------------------------------|--------------|
| 1    | Water Conditioner and Transfer Unit                   | 430-5030     |
| 2    | Vehicle Ground Power Supply                           | 410-82140-1  |
| 3    | Data Acquisition System                               | 410-9700     |
| 4    | ACE - S/C Ground Station                              | 410-11990-1  |
| 5    | Carry-On Cable Set                                    | 410-11170    |
| 6    | 10 Volt Power Supply PCMTEA                           | 410-72021    |
| 7    | Carry On PCM System                                   | 410-92210-3  |
| 8    | Digital Signal Conditioner and Multiplex Unit C-0     | 41092211     |
| 9    | Analog Signal Conditioner and Sample Unit C-0         | 410-92212    |
| 10   | General Signal Conditioner and Switch Matrix Unit C-0 |              |
| 11   | Data Interleaver System, Miniaturized                 | 410-92232    |
| 12   | Service Equipment Adapter ACE                         | 410-92240    |
| 13   | Digital GSE System Service Equipment                  | 410-92241    |
| 14   | ACE-S/C Support Platform                              | 420-73100    |
| 15   | Junction Box - 4 units                                | 410-12731    |
| 16   | Intercom Cable Set                                    | 410-0110     |
| 17   | Intercom Patch Panel                                  | 410-09450    |
| 18   | Intercom Rack Mounted                                 | 410-09470-1  |
| 19   | Intercom Rack Mounted                                 | 410-09470-3  |
| 20   | Intercom Power Supply                                 | 410-09472    |
| 21   | Intercom Test Cord                                    | 410-09480    |
| 22   | GAEC Test Facility Cable Set                          | 410-11090-15 |
| 23   | ACE - S/C GSE DC Power Supply                         | 410-11270    |
| 24   | S/S Signal Conditioner Unit                           | 419-92484    |
| 25   | PSA Adapter                                           | 410-31080    |
| 26   | Portable Temperature Controller                       | 410-31058    |
| 27   | Breakout Box                                          | 410-1210-1   |
| 28   | Electronics Counter                                   | HP-5245L     |
| 29   | Plug In Preset Unit                                   | HP-5264A     |

## 4. Material and Equipment

4.1 The following test equipment shall be used to demonstrate the requirements of this specification. If protection to personnel and equipment is not decreased, items except government furnished parts, equivalent to those listed may be used.

| ITEM | DESCRIPTION                                           | MODEL NO.    |
|------|-------------------------------------------------------|--------------|
| 1    | Water Conditioner and Transfer Unit                   | 430-5030     |
| 2    | Vehicle Ground Power Supply                           | 410-82140-1  |
| 3    | Data Acquisition System                               | 410-9700     |
| 4    | ACE - S/C Ground Station                              | 410-11990-1  |
| 5    | Carry-On Cable Set                                    | 410-11170    |
| 6    | 10 Volt Power Supply PCMTA                            | 410-72021    |
| 7    | Carry On PCM System                                   | 410-92210-3  |
| 8    | Digital Signal Conditioner and Multiplex Unit C-0     | 41092211     |
| 9    | Analog Signal Conditioner and Sample Unit C-0         | 410-92212    |
| 10   | General Signal Conditioner and Switch Matrix Unit C-0 |              |
| 11   | Data Interleaver System, Miniaturized                 | 410-92232    |
| 12   | Service Equipment /Adapter ACE                        | 410-92240    |
| 13   | Digital CMB System Service Equipment                  | 410-92241    |
| 14   | ACE-S/C Support Platform                              | 420-73100    |
| 15   | Junction Box - 4 units                                | 410-12731    |
| 16   | Intercom Cable Set                                    | 410-0110     |
| 17   | Intercom Patch Panel                                  | 410-09450    |
| 18   | Intercom Rack Mounted                                 | 410-09470-1  |
| 19   | Intercom Rack Mounted                                 | 410-09470-3  |
| 20   | Intercom Power Supply                                 | 410-09472    |
| 21   | Intercom Test Cord                                    | 410-09480    |
| 22   | QAEK Test Facility Cable Set                          | 410-11090-15 |
| 23   | ACE - S/C GSE DC Power Supply                         | 410-11270    |
| 24   | B/S Signal Conditioner Unit                           | 419-92484    |
| 25   | PSA Adapter                                           | 410-31080    |
| 26   | Portable Temperature Controller                       | 410-31058    |
| 27   | Breakout Box                                          | 410-1210-1   |
| 28   | Electronics Counter                                   | HP-5245L     |
| 29   | Plug In Preset Unit                                   | HP-5264A     |

| ITEM    | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                      | MODEL NO. |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 30      | 5 Place Sine-Cosine Tables, Friden Calculator                                                                                                                                                                                                                                                                                                                                                                    |           |
| 31      | Dioptrimeter                                                                                                                                                                                                                                                                                                                                                                                                     |           |
| 5.      | GENERAL REQUIREMENTS                                                                                                                                                                                                                                                                                                                                                                                             |           |
| 5.1     | Safety Requirements                                                                                                                                                                                                                                                                                                                                                                                              |           |
| 5.1.1   | Operator Safety                                                                                                                                                                                                                                                                                                                                                                                                  |           |
| 5.1.1.1 | Normal safety precautions shall be observed through the G&N post-installation checkout.                                                                                                                                                                                                                                                                                                                          |           |
| 5.1.2   | Equipment Safety                                                                                                                                                                                                                                                                                                                                                                                                 |           |
| 5.1.2.1 | To preserve the operational life of the components of the G&N hardware under test, settings and adjustments shall be performed only when specified in the test procedure. Care shall be exercised in the accomplishment of all settings and adjustments to avoid excessive wear or damage to the equipment. All precautionary measures stated throughout the test procedures shall be strictly adhered to.       |           |
| 5.1.2.2 | The connection between the Portable Temperature Controller (PTC) and 56J1 shall be maintained unless otherwise specified.                                                                                                                                                                                                                                                                                        |           |
| 5.1.2.3 | The temperature of the inertial components shall be maintained between the following limits. If these limits are exceeded, the inertial components shall be recalibrated. <ul style="list-style-type: none"> <li>a. IRIG: 120 Deg F and 150 Deg F</li> <li>b. PIP: 115 Deg F and 145 Deg F</li> </ul>                                                                                                            |           |
| 5.1.2.4 | All personnel concerned shall thoroughly understand the Operational Requirements in Section 6.2 to preclude any damage to the G&N System.                                                                                                                                                                                                                                                                        |           |
| 5.2     | Coolant Requirements                                                                                                                                                                                                                                                                                                                                                                                             |           |
| 5.2.1   | When electrical power is applied to the G&N System, the IMU shall be provided with water-glycol coolant at a temperature of 32-50 deg F and a flow rate of 33 ± 5 pounds per hour.                                                                                                                                                                                                                               |           |
| 5.2.2   | The PSA, CDU, and PTA cold plates shall be provided with coolant as per ICD LIS-510-10001.                                                                                                                                                                                                                                                                                                                       |           |
| 5.3     | Test Equipment Tolerances                                                                                                                                                                                                                                                                                                                                                                                        |           |
| 5.3.1   | Measurements and tolerances specifications stated herein are basic G&N System performance specifications. Calibration data must be supplied to the Acceptance Checkout Equipment (ACE) for the Power and Servo Assembly Adapter Module (PSAAM) and Signal Conditioner Assembly (SCA) performance. Final tolerances must include PSAAM and Signal Conditioner stability uncertainties (See Appendix 1) as well as |           |

| ITEM    | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                      | MODEL NO. |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 30      | 5 Place Sine-Cosine Tables, Friden Calculator                                                                                                                                                                                                                                                                                                                                                                    |           |
| 31      | Diotometer                                                                                                                                                                                                                                                                                                                                                                                                       |           |
| 5.      | GENERAL REQUIREMENTS                                                                                                                                                                                                                                                                                                                                                                                             |           |
| 5.1     | Safety Requirements                                                                                                                                                                                                                                                                                                                                                                                              |           |
| 5.1.1   | Operator Safety                                                                                                                                                                                                                                                                                                                                                                                                  |           |
| 5.1.1.1 | Normal safety precautions shall be observed through the G&N post-installation checkout.                                                                                                                                                                                                                                                                                                                          |           |
| 5.1.2   | Equipment Safety                                                                                                                                                                                                                                                                                                                                                                                                 |           |
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ACE and ACE carry-on conditioning uncertainties. All uncertainties due to instrumentation shall be root sum squared with the basic G&N subsystem tolerance to yield an acceptable tolerance for use when testing the G&N system in the spacecraft.

5.3.2 In the event of a conflict between requirements, the following order of procedure shall apply. The contractor shall also notify AC Electronics Site Manager of the conflict.

- a. The contract
- b. The Specification
- c. Documents referenced in this specification.

5.4 Test Sequence

5.4.1 The test sequence shall normally follow the flow gram in figure 1. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.

5.5 The generation of noise alarm indication, as evidenced by one or more Noise Peak Event Lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

5.6 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N system as non-conforming. Normal test sequence may be continued upon determination of the cause of the non conformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All non conformances shall be investigated and cleared by waivers (F.N.W), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory where the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.

5.7 After the defective, replaceable element has been substituted with a flight certified unit, the G&N System checkout sequence shall regress to the rerunning of applicable portions of the selected sequence (by paragraph number) categorized by the subassemblies in which the malfunction occurred. The chosen subassembly categories are presented in Table I versus an appropriate retest paragraph sequence as a guide for retest. Retest shall be conducted by performing applicable portions of indicated paragraph numbers in the sequence listed as indicated under the appropriate subassembly heading or as directed by NASA Test Engineering. Retest shall proceed to the point in the normal

ACE and ACE carry-on conditioning uncertainties. All uncertainties due to instrumentation shall be root sum squared with the basic G&N subsystem tolerance to yield an acceptable tolerance for use when testing the G&N system in the spacecraft.

- 5.3.2 In the event of a conflict between requirements, the following order of procedure shall apply. The contractor shall also notify AC Electronics Site Manager of the conflict.

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- 5.4.1 The test sequence shall normally follow the flow gram in figure 1. Any test subsequent to Temperature Control Verification Section 6.3.4 may be conducted providing the General Turn On Procedure 6.2.4 is followed.

- 5.5 The generation of noise alarm indication, as evidenced by one or more Noise Peak Event Lamps becoming lighted shall be cause for immediate determination of effects on the G&N system test in progress. In the event of detrimental effects on the system test a troubleshooting routine shall be entered to determine the cause of the alarm. Testing shall continue only after demonstrating that the cause of the noise alarm has been located and that remedial action has been or will be taken, or that the transient or noise causing the alarm has no detrimental effect on the G&N System or test in progress.

- 5.6 Failure of the G&N System to pass any examination or test specified herein shall tentatively classify the G&N system as non-conforming. Normal test sequence may be continued upon determination of the cause of the non conformance or at the discretion of the G&N contractor test team if it is determined that such action is not detrimental to the G&N System or other interfacing subsystems. All non conformances shall be investigated and cleared by waivers (F.N.W), correction of specification, or hardware replacement and retest. The suspected malfunctioned hardware shall be removed and returned to the laboratory where the malfunction shall be verified. Only after malfunction verification shall a flight certified replaceable element be installed in the G&N System.

- 5.7 After the defective, replaceable element has been substituted with a flight certified unit, the G&N System checkout sequence shall regress to the rerunning of applicable portions of the selected sequence (by paragraph number) categorized by the subassemblies in which the malfunction occurred. The chosen subassembly categories are presented in Table I versus an appropriate retest paragraph sequence as a guide for retest. Retest shall be conducted by performing applicable portions of indicated paragraph numbers in the sequence listed as indicated under the appropriate subassembly heading or as directed by NASA Test Engineering. Retest shall proceed to the point in the normal



TABLE I RETEST SEQUENCE

APOLLO GAN Specification  
ND 1002349

| Paragraph Number | Test Title                       | LOC | IMU | PFA | CHU | PTA | ISRY | A HANESS | B HANESS | Computer Control & Reticle Illuminator | Nav Base | Alignment Optical Telescope | Signal Conditioner |
|------------------|----------------------------------|-----|-----|-----|-----|-----|------|----------|----------|----------------------------------------|----------|-----------------------------|--------------------|
| 6.3.1            | Standby Power On Test            | X   | X   | X   |     |     | X    | X        | X        |                                        |          |                             |                    |
| 6.3.2            | Alarms and Interrupts Test       | X   |     |     |     |     | X    | X        |          |                                        |          |                             |                    |
| 6.3.3            | IMU Operate Power On Test        |     | X   | X   | X   | X   |      | X        | X        |                                        |          |                             | X                  |
| 6.3.4            | Temperature Control Verification |     | X   | X   |     |     |      | X        | X        |                                        | X        |                             | X                  |
| 6.3.5            | PGMCS Power Supply Test          |     |     | X   | X   | X   |      | X        | X        |                                        | X        |                             | X                  |
| 6.3.6            | IMU Operational Test             | X   | X   | X   | X   | X   |      | X        | X        |                                        |          |                             |                    |
| 6.3.7            | PGMCS Operational Test           |     | X   | X   | X   |     |      | X        | X        |                                        | X        |                             | X                  |
| 6.3.8            | IRIG Scale Factor Test           |     | X   | X   |     | X   |      | X        | X        |                                        | X        |                             |                    |
| 6.3.9            | IMU Performance Test             |     | X   | X   |     | X   |      | X        | X        |                                        | X        |                             |                    |
| 6.3.10           | LOC Voltage Margin Test          | X   |     |     |     |     |      | X        |          |                                        |          |                             |                    |
| 6.3.11           | LOC Clock Frequency Test         | X   |     |     |     |     |      | X        |          | X                                      |          |                             |                    |
| 6.3.12           | Gimbal Friction Test             |     | X   | X   |     |     |      | X        | X        |                                        | X        |                             | X                  |
| 6.3.13           | Stabilization Loop Response Test |     | X   | X   |     | X   |      | X        | X        |                                        | X        |                             |                    |
| 6.3.14           | GAN Fine Alignment Test          |     | X   | X   | X   |     |      | X        | X        |                                        | X        | X                           |                    |
| 6.3.15           | AOT Functional Performance Test  |     |     |     |     |     |      |          |          |                                        |          | X                           |                    |
| 6.2.1            | Emergency Shutdown Procedure     | *   | *   | *   | *   | *   | *    | *        | *        | *                                      | *        | *                           | *                  |
| 6.2.2            | Normal Shutdown Procedure        | *   | *   | *   | *   | *   | *    | *        | *        | *                                      | *        | *                           | *                  |
| 6.2.3            | Initial Turn-On Procedure        | *   | *   | *   | *   | *   | *    | *        | *        | *                                      | *        | *                           | *                  |
| 6.2.4            | General Turn-ON Procedure        | *   | *   | *   | *   | *   | *    | *        | *        | *                                      | *        | *                           | *                  |

\* To be used as necessary to turn system on or off.

TABLE I RETEST SEQUENCE

APOLLO GAN Specification  
WD 1002349

| Paragraph<br>Number | Test Title                       | LGC | IMU | PSA | CDU | PTA | DEK | A HARNESS | B HARNESS | Computer Control &<br>Reticle Dimmer | Nav Base | Alignment Optical<br>Telescope | Signal Conditioner |
|---------------------|----------------------------------|-----|-----|-----|-----|-----|-----|-----------|-----------|--------------------------------------|----------|--------------------------------|--------------------|
| 6.3.1               | Standby Power On Test            | X   | X   | X   |     |     | X   | X         | X         |                                      | X        |                                |                    |
| 6.3.2               | Alarms and Interrupts Test       | X   |     |     |     |     | X   | X         |           |                                      |          |                                |                    |
| 6.3.3               | IMU Operate Power On Test        |     | X   | X   | X   | X   |     | X         | X         |                                      | X        |                                | X                  |
| 6.3.4               | Temperature Control Verification |     | X   | X   |     |     |     | X         | X         |                                      | X        |                                | X                  |
| 6.3.5               | PGNCS Power Supply Test          |     |     | X   | X   | X   |     | X         | X         |                                      | X        |                                | X                  |
| 6.3.6               | IMU Operational Test             | X   | X   | X   | X   | X   |     | X         | X         |                                      | X        |                                |                    |
| 6.3.7               | PGNCS Operational Test           |     | X   | X   | X   |     |     | X         | X         |                                      | X        |                                | X                  |
| 6.3.8               | IRIG Scale Factor Test           |     | X   | X   |     | X   |     | X         | X         |                                      | X        |                                |                    |
| 6.3.9               | IMU Performance Test             |     | X   | X   |     | X   |     | X         | X         |                                      | X        |                                |                    |
| 6.3.10              | LGC Voltage Margin Test          | X   |     |     |     |     |     | X         |           |                                      |          |                                |                    |
| 6.3.11              | LGC Clock Frequency Test         | X   |     |     |     |     |     | X         |           | X                                    |          |                                |                    |
| 6.3.12              | Gimbal Friction Test             |     | X   | X   |     |     |     | X         | X         |                                      | X        |                                | X                  |
| 6.3.13              | Stabilization Loop Response Test |     | X   | X   |     | X   |     | X         | X         |                                      | X        |                                |                    |
| 6.3.14              | GAN Fine Alignment Test          |     | X   | X   | X   |     |     | X         | X         |                                      | X        | X                              |                    |
| 6.3.15              | AOT Functional Performance Test  |     |     |     |     |     |     |           |           |                                      |          |                                |                    |
| 6.2.1               | Emergency Shutdown Procedure     | *   | *   | *   | *   | *   | *   | *         | *         | *                                    | *        | *                              | *                  |
| 6.2.2               | Normal Shutdown Procedure        | *   | *   | *   | *   | *   | *   | *         | *         | *                                    | *        | *                              | *                  |
| 6.2.3               | Initial Turn-On Procedure        | *   | *   | *   | *   | *   | *   | *         | *         | *                                    | *        | *                              | *                  |
| 6.2.4               | General Turn-ON Procedure        | *   | *   | *   | *   | *   | *   | *         | *         | *                                    | *        | *                              | *                  |

\* To be used as necessary to turn system on or off.

test sequence at which the discrepancy was detected and corrected. Normal testing shall continue beyond this point in the specified sequence of Figure 2.

- 5.8 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.
- 5.9 Spacecraft systems other than the G&N System may be operating on a noninterfering basis while individual system checkout of the G&N is being conducted.
- 5.10 Data Retrieval
- 5.10.1 All data concerning the checkout and operation of the G&N System as monitored via ACE, shall be recorded on the data sheets associated with their corresponding test. Out of tolerance readings shall be recorded and flagged by appropriate signals.
- 5.10.2 During G&N system testing, all interleaved data, Uplink Command File and Downlink Data File shall be maintained (recorders ON). All A/B PCM data, that is not made available to the ACE displays shall be verified by requesting a time history data strip out of said data for the time period when the test was performed.

| Paragraph No. | Test Title                              |
|---------------|-----------------------------------------|
| 6.3.1         | Standby Power In Test                   |
| 6.3.2         | Alarm and Interrupts Test               |
| 6.3.3         | IDU Operate Power On Test               |
| 6.3.4         | Temperature Control Verification        |
| 6.3.5         | PGNCS Power Supply Test                 |
| 6.3.6         | IDU Operational Test                    |
| 6.3.7         | PGNCS Operational Test                  |
| 6.3.8         | IRIS Scale Factor Test                  |
| 6.3.9         | IDU Performance Test                    |
| 6.3.10        | LGC Voltage Margin Test                 |
| 6.3.11        | LGC Clock Frequency Test                |
| 6.3.12        | Gimbal Friction Test                    |
| 6.3.13        | Stabilization Loop Response Test        |
| 6.3.14        | G and H Fine Alignment Test             |
| 6.3.15        | AOI Functional Performance Test         |
| 6.3.16        | Flight Rope Fixed Memory Bank Sam Check |
| 6.3.17        | LGC Clock Alignment Test                |

TEST SEQUENCE  
Figure 1

test sequence at which the discrepancy was detected and corrected. Normal testing shall continue beyond this point in the specified sequence of Figure 2.

- 5.8 It is assumed that the Test Conductor has a working knowledge of the test equipment used; therefore, this procedure contains only the steps pertaining directly to the G&N components. If any questions arise concerning the test equipment, the Test Conductor should refer to the respective operational manuals.
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| Paragraph No. | Test Title                              |
|---------------|-----------------------------------------|
| 6.3.1         | Standby Power In Test                   |
| 6.3.2         | Alarms and Interrupts Test              |
| 6.3.3         | IMU Operate Power On Test               |
| 6.3.4         | Temperature Control Verification        |
| 6.3.5         | PONCS Power Supply Test                 |
| 6.3.6         | IMU Operational Test                    |
| 6.3.7         | PONCS Operational Test                  |
| 6.3.8         | IRIG Scale Factor Test                  |
| 6.3.9         | IMU Performance Test                    |
| 6.3.10        | LGC Voltage Margin Test                 |
| 6.3.11        | LGC Clock Frequency Test                |
| 6.3.12        | Gimbal Friction Test                    |
| 6.3.13        | Stabilization Loop Response Test        |
| 6.3.14        | G and N Fine Alignment Test             |
| 6.3.15        | ACT Functional Performance Test         |
| 6.3.16        | Flight Rope Fixed Memory Bank Sum Check |
| 6.3.17        | LGC Clock Alignment Test                |

TEST SEQUENCE  
Figure 1

6. DETAILED REQUIREMENTS

6.1. Initial Test Conditions

6.1.1 The IMU shall be supplied with heater power on a continuous basis. The portable temperature controller (Model No. 410-31058) shall be connected at all times although heater power may be supplied from the +28 VDC IMU STANDBY bus and monitored through ACE.

6.1.2 The IMU shall never be without heater power longer than 15 minutes.

6.2. Operational Requirements

NOTE: In the event that an Electrical Power Subsystem (EPS) shutdown occurs for any reason while the G&N System is in the Operate Mode, turn off the +28VDC IMU OPERATE circuit breaker or LEM Cabin Panel 11. Do not turn the +28VDC IMU OPERATE Circuit breaker on for a minimum of 5 minutes after the EPS shutdown occurs. Failure to observe this requirement can result in shifts of the critical Inertial Component parameters.

6.2.1. Emergency Shutdown Procedure

CAUTION

In the event of any malfunction which might damage the G&N System before the normal shutdown procedure in 6.2.2. can be performed, power shall be removed from the G&N System as soon as possible. If at all possible, without creating any delay, IMU Operate Power should be removed first.

6.2.2. Normal Shutdown Procedure

6.2.2.1 The normal shutdown of a G&N System shall include parking the gimbals prior to removing IMU Operate Power. This is accomplished in the following procedure.

6.2.2.2 On K-148 enter the following sequence:  
VERB 41 NOUW 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+09000 ENTER

6.2.2.3 On the CRT, verify the following platform angles are displayed:

IG is between 358 and 002  
MG is between 088 and 092  
OG is between 358 and 002  
Verify Gimbal Lock Lamp is lighted.

6.2.2.4 Pull out +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11 to remove IMU OPERATE power.

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NOTE: In the event that an Electrical Power Subsystem (EPS) shutdown occurs for any reason while the G&N System is in the Operate Mode, turn off the +28VDC IMU OPERATE circuit breaker or LEM Cabin Panel 11. Do not turn the +28VDC IMU OPERATE Circuit breaker on for a minimum of 5 minutes after the EPS shutdown occurs. Failure to observe this requirement can result in shifts of the critical Inertial Component parameters.

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+00000 ENTR  
+00000 ENTR  
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IG is between 358 and 002  
MG is between 088 and 092  
OG is between 358 and 002  
Verify Gimbal Lock Lamp is lighted.

6.2.2.4 Pull out +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11 to remove IMU OPERATE power.

- 6.2.2.5 Pull out +28VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11 to remove LGC OPERATE power.
- 6.2.2.6 Pull out +28VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11 to remove IMU STANDBY power.
- 6.2.3 Initial Turn-On Procedure
  - 6.2.3.1 Proper coolant flow shall be verified prior to application of any power to the G&N System.
  - 6.3.3.2 The initial power turn-on sequence shall be in the order specified in the test procedures (6.3) observing all cautions and delays as specified.
- 6.2.4 General Turn-On Procedure
  - 6.2.4.1 This step shall be effective only after having completed the initial turn-on procedures.
  - 6.2.4.2 Proper coolant flow shall be verified.
  - 6.2.4.3 Depress +28VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11 to supply IMU STANDBY power. Record time
  - 6.2.4.4 Depress +28VDC LGC OPERATE circuit breaker on LEM Cabin Panel 11 to supply LGC Operate Power.
  - 6.2.4.5 Depress STBY pushbutton on DEKY for 3 seconds and verify STBY light on DEKY is off.
  - 6.2.4.6 On K-148 enter the following sequence:  
Press ERROR RESET  
VERB 36 ENTER (fresh start)  
VERB 57 ENTER  
00015 ENTER  
VERB 21 MOUN 27 ENTER  
77777 ENTER (LGC Self Check)
  - 6.2.4.7 On the CRT, verify that the 3.2KC 28V Supply indicates between 28.04 and 29.16 VRMS (OG 1331).
  - 6.2.4.8 On the CRT DEKY display verify that R1 does not display 01102 or 41102 (indicating a malfunction).
  - 6.2.4.9 After 9 minutes, stop LGC Self Check by entering the following in K-148:  
VERB 21 MOUN 27 ENTER  
00000 ENTER

6.2.4.10 **CAUTION:** LOC OPERATE and IMU STANDBY power must have been applied a minimum of two hours before energizing the IMU OPERATE circuit breaker in step 6.2.4.16 unless all of the following conditions are met:

- IF:
1. The G&N System has previously been in Standby Mode at least two hours and subsequently been in Operate Mode, AND
  2. The gimbals were placed in a parked position prior to shutdown, AND
  3. The shutdown period did not exceed 5 days, AND
  4. The Spacecraft or IMU have not been moved in any way during the shutdown period.

THEN: The two-hour Standby Mode operation requirement is reduced to 15 minutes.

6.2.4.11 The G&N System is defined as being in Standby Mode when LOC Operate and IMU Standby power is applied and IMU Operate power is off. The inertial components shall have suspension power in Standby Mode.

6.2.4.12 The G&N System is defined as being in Operate Mode when LOC OPERATE, IMU STANDBY and IMU OPERATE POWER is applied to the system.

6.2.4.13 Set up analog recorder to monitor the following signals:

| Signal No. | Signal Name                     |
|------------|---------------------------------|
| a. OG 2136 | MG Servo Error Total            |
| b. OG 2106 | IG Servo Error Total            |
| c. OG 2166 | OG Servo Error Total            |
| d. OG 2112 | IG 1X Resolver Sine             |
| e. OG 2172 | OG 1X Resolver Sine             |
| f. OG 2142 | MG 1X Resolver Sine             |
| g. OG 1201 | IMU 26V 1 $\frac{1}{2}$ 800 CPS |

6.2.4.14 Start the analog recorder at a chart speed of 5 mm/sec. Start the event recorder at a chart speed of 1 mm/sec. (10,000 mm/sec).

6.2.4.15 On CRT, monitor +120 VDC FIPA SUPPLY (OG 1040) and IMU Gimbal angles. Record time. If 15 minutes have elapsed since performing paragraph 6.2.4.3 proceed to the next paragraph.

6.2.4.16 Press in +28VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

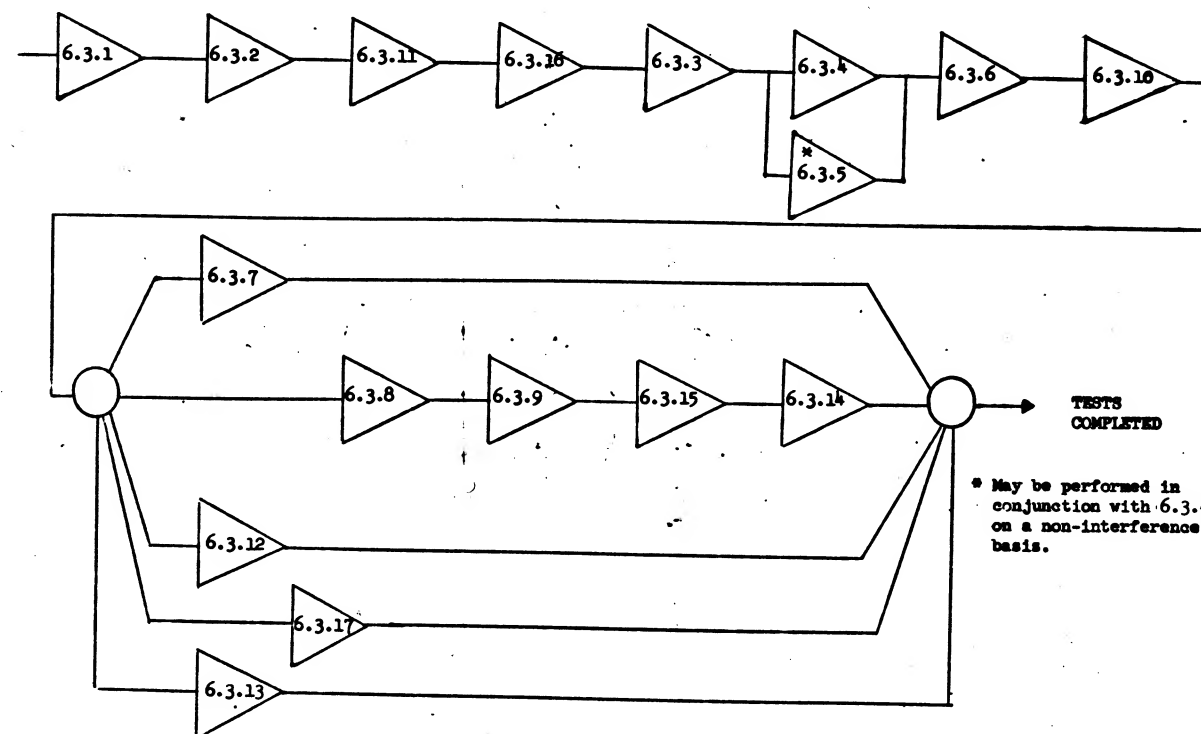


- 6.2.4.10 **CAUTION:** LOC OPERATE and IMU STANDBY power must have been applied a minimum of two hours before energizing the IMU OPERATE circuit breaker in step 6.2.4.16 unless all of the following conditions are met:
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1. The G&N System has previously been in Standby Mode at least two hours and subsequently been in Operate Mode, AND
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  4. The Spacecraft or IMU have not been moved in any way during the shutdown period.
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- 6.2.4.13 Set up analog recorder to monitor the following signals:
- | Signal No. | Signal Name          |
|------------|----------------------|
| a. GG 2136 | NG Servo Error Total |
| b. GG 2106 | ID Servo Error Total |
| c. GG 2166 | OG Servo Error Total |
| d. GG 2112 | ID 1X Resolver Sine  |
| e. GG 2172 | OG 1X Resolver Sine  |
| f. GG 2142 | NG 1X Resolver Sine  |
| g. GG 1201 | IMU 28V 14 800 CPS   |
- 6.2.4.14 Start the analog recorder at a chart speed of 5 mm/sec. Start the event recorder at a chart speed of 10 mm/sec.
- 6.2.4.15 On CRT, monitor +120 VDC PIPA SUPPLY (GG 1040) and IMU Gimbal angles. Record time. If 15 minutes have elapsed since performing paragraph 6.2.4.3 proceed to the next paragraph.
- 6.2.4.16 Press in +28VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

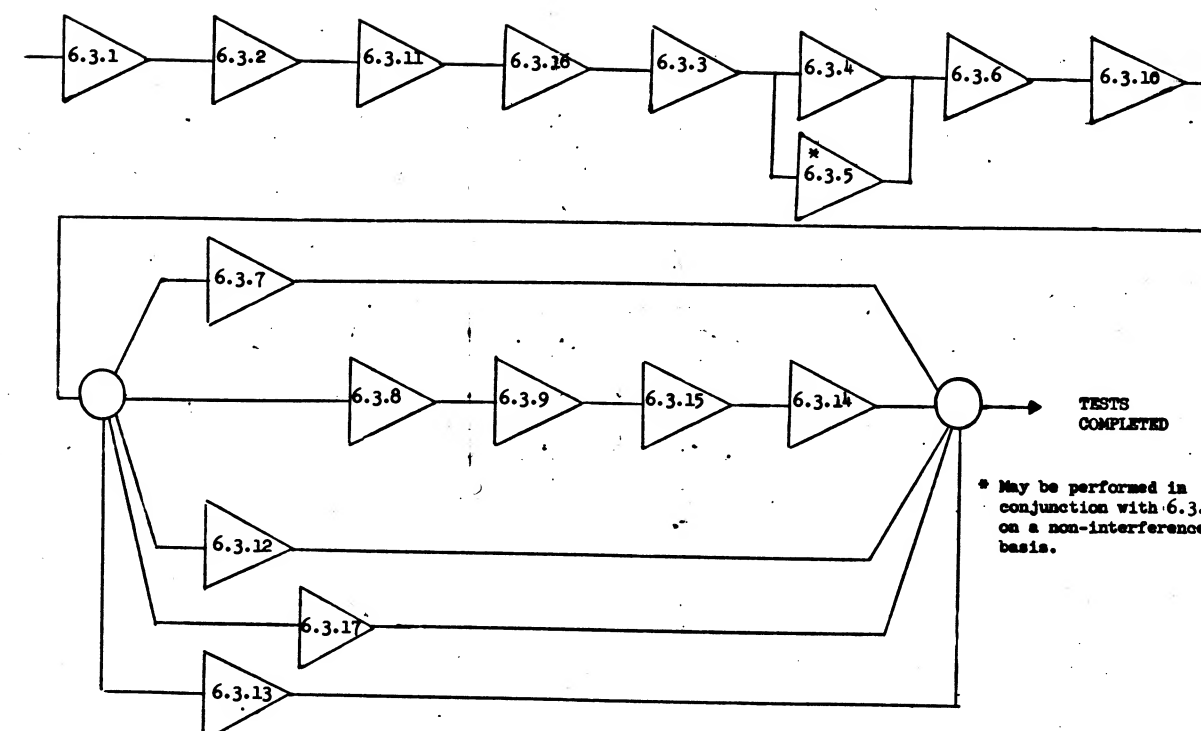
- 6.2.4.17 Verify on the analog recorder that the oscillations of the resolver sine signals (GG 2112, GG 2172, and GG 2142) are not sustained and that the signals damp out within 15 seconds. If this condition is not attained, remove IMU OPERATE power immediately.
- 6.2.4.18 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for  $90 \pm 10$  seconds after step 6.2.4.16 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.2.4.16.
- 6.2.4.19 Verify absence of LGC WARNING, ISS WARNING, and RWCS CAUTION lights in the LEM cabin.
- 6.2.4.20 On the CRT, verify all IMU Gimbal angles between 358 and 002.
- 6.2.4.21 On K-148 enter the following sequence:
- ```

VERB 41      NOUN 20      ENTER
+00000  ENTER
+00000  ENTER
+00000  ENTER
    
```
- 6.2.4.22 On the CRT, scan the power supply voltages to verify their normal operation. (No indications flashing).
- 6.2.4.23 After all the tests of 6.3 in Figure 1 have been completed, the General Turn-On Procedure (6.2.4) and IMU Operational Test (6.3.6) shall be completed before re-running any test. Otherwise, the testing sequence shall continue in accordance with Figure 2.
- 6.2.5 Interruption of Power.
- 6.2.5.1 IMU Operate power shall never be applied without the presence of LGC Operate and IMU Standby Power.
- 6.2.5.2 The G&N System log book shall include the gimbal positions at time of power shutdown. If omitted, it shall be assumed that the gimbals were not parked prior to shutdown. The logbook shall also state if any movement of the IMU or Spacecraft has taken place after shutdown. The times of application and removal of any bus power to the G&N System shall be recorded.

- 6.2.4.17 Verify on the analog recorder that the oscillations of the resolver sine signals (GG 2112, GG 2172, and GG 2142) are not sustained and that the signals damp out within 15 seconds. If this condition is not attained, remove IMU OPERATE power immediately.
- 6.2.4.18 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90 ± 10 seconds after step 6.2.4.16 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.2.4.16.
- 6.2.4.19 Verify absence of LGC WARNING, ISS WARNING, and PGWCS CAUTION lights in the LEM cabin.
- 6.2.4.20 On the CRT, verify all IMU Gimbal angles between 358 and 002.
- 6.2.4.21 On K-148 enter the following sequence:
- ```
VERB 41 NOUN 20 ENTER
+00000 ENTER
+00000 ENTER
+00000 ENTER
```
- 6.2.4.22 On the CRT, scan the power supply voltages to verify their normal operation. (No indications flashing).
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TEST PROCEDURE FLOWGRAM  
FIGURE 2



TEST PROCEDURE FLOWGRAM  
FIGURE 2

- 6.2.6 A warmup period of at least one hour in Operate Mode is required prior to performing any test in which gyro or accelerometer parameters are measured, and at least 15 minutes prior to any test in which precision amplitude and frequency power supply checks are made.

### 6.3 Test Procedures

#### 6.3.1 Standby Power On Tests

- 6.3.1.1 The Portable Temperature Controller, Model No. 400-31058 shall be supplying inertial component heater power to the G&N System through connector 56J1 (P230). If alarm or fail indications are present on the PTC, they shall be cleared by depressing the SYSTEM RESET push-button on the PTC.

- 6.3.1.2 The following switches and/or circuit breakers shall be closed to energize the indicated buses.

| LOCATION | NOMENCLATURE             | IDENTIFICATION |
|----------|--------------------------|----------------|
| Panel 14 | BAT 5 NORMAL FEED        | 4810           |
| Panel 14 | BAT 6 NORMAL FEED        | 4811           |
| Panel 16 | X LUNAR BUS TIE          | 4CB5           |
| Panel 16 | BAT 1-4-6 FEED TIE       | 4CB17          |
| Panel 16 | BAT 2-3-5 FEED TIE       | 4CB25          |
| Panel 16 | ASC ECA                  | 4CB14          |
| Panel 16 | ASC ECA CONT.            | 5CB7           |
| Panel 16 | DC BUS VOLT              | 4CB21          |
| Panel 16 | HISP.                    | 4CB16          |
| Panel 11 | X LUNAR BUS TIE          | 4CB4           |
| Panel 11 | BAT 1-4-6 FEED TIE       | 4CB18          |
| Panel 11 | BAT 2-3-5 FEED TIE       | 4CB26          |
| Panel 11 | ASC ECA                  | 4CB13          |
| Panel 11 | ASC ECA CONT.            | 4CB6           |
| Panel 11 | DC BUS VOLT              | 4CB22          |
| Panel 16 | INV. NO. 2               | 4CB13          |
| Panel 14 | AC PWR to INV 2 Position | 4814           |
| Panel 11 | AC BUS FEED TIE          | 4CB24          |
| Panel 11 | AC BUS VOLT              | 4CB27          |

#### 6.3.1.3 IMU Standby Power Turn On

- 6.3.1.3.1 Turn on Event Recorder to a speed of 10 mm/sec. (10,000 rpm/sec).
- 6.3.1.3.2 Press in +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11. Record time.
- 6.3.1.3.3 Verify on the Event Recorder that +28 VDC IMU STANDBY power discrete (GG 1513) is on. On CRT +28V IMU STANDBY Bus (GG 1510) shall indicate between 24.5 and 33.5

- 6.2.6 A warmup period of at least one hour in Operate Mode is required prior to performing any test in which gyro or accelerometer parameters are measured, and at least 15 minutes prior to any test in which precision amplitude and frequency power supply checks are made.

### 6.3 Test Procedures

#### 6.3.1 Standby Power On Tests

- 6.3.1.1 The Portable Temperature Controller, Model No. 400-31058 shall be supplying inertial component heater power to the G&N System through connector 56J1 (P230). If alarm or fail indications are present on the PTC, they shall be cleared by depressing the SYSTEM RESET push-button on the PTC.

- 6.3.1.2 The following switches and/or circuit breakers shall be closed to energize the indicated buses.

| LOCATION | NOMENCLATURE             | IDENTIFICATION |
|----------|--------------------------|----------------|
| Panel 14 | BAT 5 NORMAL FEED        | 4S10           |
| Panel 14 | BAT 6 NORMAL FEED        | 4S11           |
| Panel 16 | X LUNAR BUS TIE          | 4CB5           |
| Panel 16 | BAT 1-4-6 FEED TIE       | 4CB17          |
| Panel 16 | BAT 2-3-5 FEED TIE       | 4CB25          |
| Panel 16 | ASC ECA                  | 4CB14          |
| Panel 16 | ASC ECA CONT.            | 5CB7           |
| Panel 16 | DC BUS VOLT              | 4CB21          |
| Panel 16 | HISP.                    | 4CB16          |
| Panel 11 | X LUNAR BUS TIE          | 4CB4           |
| Panel 11 | BAT 1-4-6 FEED TIE       | 4CB18          |
| Panel 11 | BAT 2-3-5 FEED TIE       | 4CB26          |
| Panel 11 | ASC ECA                  | 4CB15          |
| Panel 11 | ASC ECA CONT.            | 4CB6           |
| Panel 11 | DC BUS VOLT              | 4CB22          |
| Panel 16 | INV. NO. 2               | 4CB13          |
| Panel 14 | AC PWR to INV 2 Position | 4S14           |
| Panel 11 | AC BUS FEED TIE          | 4CB24          |
| Panel 11 | AC BUS VOLT              | 4CB27          |

#### 6.3.1.3 IMU Standby Power Turn On

- 6.3.1.3.1 Turn on Event Recorder to a speed of 10 mm/sec. (10,000 rpm/sec).
- 6.3.1.3.2 Press in +28 VDC IMU STANDBY circuit breaker on LEM Cabin Panel 11. Record time.
- 6.3.1.3.3 Verify on the Event Recorder that +28 VDC IMU STANDBY power discrete (00 1513) is on. On CRT +28V IMU STANDBY Bus (00 1510) shall indicate between 24.5 and 33.5

- 6.3.1.3.4 On CRT the 28V 3200 CPS SUPPLY (GG 1331) shall indicate between 28.04 and 29.16 VRMS. Record this value.
- 6.3.1.3.5 The PIPA TEMP, displayed on CRT, shall be monitored periodically one hour to ensure that the PIPA Temperature Control circuitry is operating to maintain a temperature of  $130 \pm 5.0$  Deg. F. (GG 2300). Two hours after performing step 6.3.1.3.2 record PIPA TEMP.
- 6.3.1.4 Computer Power Turn On
  - 6.3.1.4.1 Press in +28VDC LGC OPERATE circuit breaker (4CB122) on LEM Cabin Panel 11.
  - 6.3.1.4.2 Depress STBY pushbutton on DSKY for three seconds and verify STBY light on DSKY is OFF.
  - 6.3.1.4.3 On CRT, +28V LGC Operate Bus (GG1520) shall indicate between 24.5 and 33.5. Ignore computer alarm indications. Using DSKY, enter VERB 36, then press RSET. All computer alarms shall clear.
  - 6.3.1.4.4 On CRT, the +14VDC LGC SUPPLY (GG 1020) shall indicate between 13.8 and 14.2 VDC. Record this value.
  - 6.3.1.4.5 On CRT, the +4VDC LGC SUPPLY (GG 1030) shall indicate between 3.85 and 4.15 VDC. Record this value.
- 6.3.1.5. LGC Operational Tests
  - 6.3.1.5.1 DSKY Check
    - 6.3.1.5.1.1 Initiate the DSKY check by entering in the DSKY:  
Press Error Reset  
VERB 57 EWTR 00015 EWTR (clear erasable memory)  
VERB 21 MOUN 27 EWTR  
00011 EWTR
    - 6.3.1.5.1.2 All the electroluminescent elements (PROG, VERB, MOUN and Row 1, Row 2, Row 3) shall display the decimal number nine (9). Including the 9's, the following shall be displayed for approximately 5 seconds.
      - a. 9's
      - b. 8's
      - c. 7's
      - d. 6's
      - e. 5's
      - f. 4's
      - g. 3's
      - h. 2's
      - i. 1's
      - j. 0's
      - k. Minus signs in Row 1, Row 2, Row 3
      - l. VERB-MOUN Flashing
      - m. COMP ACTY

On concurrently for 5 seconds



- 6.3.1.3.4 On CRT the 28V 3200 CPS SUPPLY (GG 1331) shall indicate between 28.04 and 29.16 VRMS. Record this value.
- 6.3.1.3.5 The PIPA TEMP, displayed on CRT, shall be monitored periodically one hour to ensure that the PIPA Temperature Control circuitry is operating to maintain a temperature of  $130 \pm 5.0$  Deg. F. (GG 2300). Two hours after performing step 6.3.1.3.2 record PIPA TEMP.
- 6.3.1.4 Computer Power Turn On
  - 6.3.1.4.1 Press in +28VDC LDC OPERATE circuit breaker (ACB122) on LEM Cabin Panel 11.
  - 6.3.1.4.2 Depress STBY pushbutton on DSKY for three seconds and verify STBY light on DSKY is OFF.
  - 6.3.1.4.3 On CRT, +28V LDC Operate Bus (GG1520) shall indicate between 24.5 and 33.5. Ignore computer alarm indications. Using DSKY, enter VERB 36, then press RSET. All computer alarms shall clear.
  - 6.3.1.4.4 On CRT, the +14VDC LDC SUPPLY (GG 1020) shall indicate between 13.8 and 14.2 VDC. Record this value.
  - 6.3.1.4.5 On CRT, the +4VDC LDC SUPPLY (GG 1030) shall indicate between 3.85 and 4.15 VDC. Record this value.
- 6.3.1.5 LDC Operational Tests
  - 6.3.1.5.1 DSKY Check
    - 6.3.1.5.1.1 Initiate the DSKY check by entering in the DSKY:  
Press Error Reset  
VERB 57 ENTER 00015 ENTER (clear erasable memory)  
VERB 21 NOUN 27 ENTER  
00011 ENTER
    - 6.3.1.5.1.2 All the electroluminescent elements (PROG, VERB, NOUN and Row 1, Row 2, Row 3) shall display the decimal number nine (9). Including the 9's, the following shall be displayed for approximately 5 seconds.
      - a. 9's
      - b. 8's
      - c. 7's
      - d. 6's
      - e. 5's
      - f. 4's
      - g. 3's
      - h. 2's
      - i. 1's
      - j. 0's
      - k. Minus signs in Row 1, Row 2, Row 3
      - l. VERB-NOUN Flashing
      - m. COMP ACTY

On concurrently for 5 seconds

- e. Plus signs in ROW 1, ROW 2, ROW 3 } On concurrently for 5 seconds
- f. VERB-NOUN Flashing
- g. COMP ACTY
- h. COMP ACTY - On for 5 seconds then DSKY blanks

6.3.1.5.1.3 The DSKY pushbuttons shall be checked by entering:  
 VERB 25 NOUN 01 ENTR  
 01740 ENTR  
 +00123 ENTR  
 -00456 ENTR  
 -00789 DO NOT press ENTR

The DSKY shall display +00123 in Row 1, -00456, in Row 2, and -00789 in Row 3. Press CLR pushbutton three times on DSKY. Observe that Row 1, Row 2 and Row 3 are blank.

6.3.1.5.2 Lamp Test

6.3.1.5.2.1 Initiate the Lamp Test by entering in the DSKY:  
 VERB 35 ENTR

6.3.1.5.2.2 The following DSKY displays shall illuminate for 5 seconds.

- a. UPLINK ACTY
  - b. NO ATT
  - c. STBY
  - d. KEY REL
  - e. TEMP
  - f. GIMBAL LOCK
  - g. PROG
  - h. RESTART
  - i. TRACKER
  - j. OPR ERROR Flashing
  - k. VERB-NOUN Flashing
  - l. Plus 88888 in Row 1
  - Row 2 and 3
- } On concurrently for 5 seconds

6.3.1.5.3 Uplink Check

6.3.1.5.3.1 On K-START 148, set LOAD/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:

ERROR RESET  
 VERB 25 NOUN 01 ENTR  
 02400 ENTR  
 +01234 ENTR  
 -56789 ENTR  
 +00000 ENTR

6.3.1.5.3.2 Verify the following is displayed on the DSKY  
 VERB 23 NOUN 01  
 R1 + 01234  
 R2 - 56789  
 R3 +00000

6.3.1.5.4 Downlink Check

- e. Plus signs in ROW 1, ROW 2, ROW 3 } On concurrently for 5 seconds
- p. VERB-NOUN Flashing
- q. COMP ACTY
- r. COMP ACTY - On for 5 seconds then DSKY blanks

6.3.1.5.1.3 The DSKY pushbuttons shall be checked by entering:

VERB 25 NOUN 01 ENTER  
01740 ENTER  
+00123 ENTER  
-00456 ENTER  
-00789 DO NOT press ENTER

The DSKY shall display +00123 in Row 1, -00456, in Row 2, and -00789 in Row 3. Press CLR pushbutton three times on DSKY. Observe that Row 1, Row 2 and Row 3 are blank.

6.3.1.5.2 Lamp Test

6.3.1.5.2.1 Initiate the Lamp Test by entering in the DSKY:

VERB 35 ENTER

6.3.1.5.2.2 The following DSKY displays shall illuminate for 5 seconds.

- a. UPLINK ACTY Row 2 and Row 3
  - b. NO ATT
  - c. STBY
  - d. KEY REL
  - e. TEMP
  - f. GIMBAL LOCK
  - g. PROG
  - h. RESTART
  - i. TRACKER
  - j. OPR ERROR Flashing
  - k. VERB-NOUN Flashing
  - l. Plus 88088 in Row 1
  - Row 2 and 3
- } On concurrently for 5 seconds

6.3.1.5.3 Uplink Check

6.3.1.5.3.1 On K-START 148, set LOAD/INHIBIT switch to LOAD, set TAPE/KEY switch to KEY, then enter the following:

ERROR RESET  
VERB 25 NOUN 01 ENTER  
02400 ENTER  
+01234 ENTER  
-56789 ENTER  
+00000 ENTER

6.3.1.5.3.2 Verify the following is displayed on the DSKY

VERB 23 NOUN 01  
R1 + 01234  
R2 - 56789  
R3 +00000

6.3.1.5.4 Downlink Check

- 6.3.1.5.4.1 On CRT, DSKY display verify the following is displayed:  
 VERB 24 MOUN 01  
 R1 + 01234  
 R2 - 56789  
 R3 + 00000
- 6.3.1.5.5 LGC Self-Check
- 6.3.1.5.5.1 On K-148 enter the following sequence to initiate the LGC Self-Check:  
 VERB 36 ENTER  
 VERB 21 MOUN 27 ENTER  
 77777 ENTER  
 VERB 15 MOUN 01 ENTER  
 01366 ENTER
- 6.3.1.5.5.2 On the CRT, verify that DSKY R1 does not display 01102 or 41102  
 If a malfunction occurs, the following is displayed:  
 R1 01102 or 41102  
 R2 XXXXX c(8 FAIL) program address +1 of point of failure  
 R3 XXXXX number of fails
- 6.3.1.5.5.3 When R3 = 00002, stop the LGC Self Check by entering in K-148  
 the following:  
 VERB 21 MOUN 27 ENTER  
 00000 ENTER
- 6.3.1.5.6 LGC Standby Check
- 6.3.1.5.6.1 On K-148 enter the following sequence:  
 VERB 21 MOUN 10 ENTER  
 00013 ENTER  
 02000 ENTER
- 6.3.1.5.6.2 On DSKY depress STBY pushbutton for approximately 3 seconds.
- 6.3.1.5.6.3 Verify STBY status indicator lamp is ON.
- 6.3.1.5.6.4 On the CRT, verify the 3.2 KC 28V Supply (QG 1331) is between  
 28.04 and 29.16 V RMS.
- 6.3.1.5.6.5 On DSKY depress STBY pushbutton for approximately 3 seconds to  
 return to LGC OPERATE mode.
- 6.3.1.5.6.6 Verify STBY status indicator lamp is OFF.
- 6.3.2 Alarms and Interrupts Test
- 6.3.2.1 Parity Fail Test
- 6.3.2.1.1 On K-148 enter the following sequence  
 VERB 21 MOUN 02 ENTER  
 01777 ENTER  
 33777 ENTER

- 6.3.1.5.4.1 On CRT, DSKY display verify the following is displayed:  
VERB 24 NOUN 01  
R1 + 01234  
R2 - 56789  
R3 + 00000
- 6.3.1.5.5 LGC Self-Check
- 6.3.1.5.5.1 On K-148 enter the following sequence to initiate the LGC Self-Check:  
VERB 36 ENTER  
VERB 21 NOUN 27 ENTER  
77777 ENTER  
VERB 15 NOUN 01 ENTER  
01366 ENTER
- 6.3.1.5.5.2 On the CRT, verify that DSKY R1 does not display 01102 or 41102  
If a malfunction occurs, the following is displayed:  
R1 01102 or 41102  
R2 XXXXX (S FAIL) program address +1 of point of failure  
R3 XXXXX number of fails
- 6.3.1.5.5.3 When R3 = 00002, stop the LGC Self Check by entering in K-148  
the following:  
VERB 21 NOUN 27 ENTER  
00000 ENTER
- 6.3.1.5.6 LGC Standby Check
- 6.3.1.5.6.1 On K-148 enter the following sequence:  
VERB 21 NOUN 10 ENTER  
00013 ENTER  
02000 ENTER
- 6.3.1.5.6.2 On DSKY depress STBY pushbutton for approximately 3 seconds.
- 6.3.1.5.6.3 Verify STBY status indicator lamp is ON.
- 6.3.1.5.6.4 On the CRT, verify the 3.2 KC 28V Supply (GG 1331) is between  
28.04 and 29.16 V RMS.
- 6.3.1.5.6.5 On DSKY depress STBY pushbutton for approximately 3 seconds to  
return to LGC OPERATE mode.
- 6.3.1.5.6.6 Verify STBY status indicator lamp is OFF.
- 6.3.2 Alarms and Interrupts Test
- 6.3.2.1 Parity Fail Test
- 6.3.2.1.1 On K-148 enter the following sequence  
VERB 21 NOUN 02 ENTER  
01777 ENTER  
33777 ENTER

- 6.3.2.1.2 On CRT, DEKY display, verify R1 = 33777 and R3 = 01777
- 6.3.2.1.3 On K-148 enter the following sequence
  - VERB 25 NOUN 26 ENTR
  - 04000 ENTR
  - 01777 ENTR
  - 00003 ENTR
  - VERB 30 ENTR
- 6.3.2.1.4 Verify RESTART, and PGNCS CAUTION lamps are ON.
- 6.3.2.1.5 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.
- 6.3.2.2 Rupt Lock-Interrupt Too Long
- 6.3.2.2.1 On K-148 enter the following sequence
  - VERB 24 NOUN 01 ENTR
  - 01777 ENTR
  - 30001 ENTR
  - 01777 ENTR
  - VERB 25 NOUN 26 ENTR
  - 00001 ENTR
  - 01777 ENTR
  - 00003 ENTR
  - VERB 31 ENTR
- 6.3.2.2.2 Verify RESTART, and PGNCS CAUTION lamps are ON.
- 6.3.2.2.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.
- 6.3.2.3 TC Trap Test
- 6.3.2.3.1 On K-148 enter the following sequence
  - VERB 21 NOUN 01 ENTR
  - 01777 ENTR
  - 01777 ENTR
  - VERB 25 NOUN 26 ENTR
  - 04000 ENTR
  - 01777 ENTR
  - 00003 ENTR
  - VERB 30 ENTR
- 6.3.2.3.2 Verify RESTART, and PGNCS CAUTION lamps are ON.
- 6.3.2.3.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

- 6.3.2.1.2 On CRT, DSKY display, verify R1 = 33777 and R3 = 01777
- 6.3.2.1.3 On K-148 enter the following sequence
  - VERB 25 NOUN 26 ENTR
  - 04000 ENTR
  - 01777 ENTR
  - 00003 ENTR
  - VERB 30 ENTR
- 6.3.2.1.4 Verify RESTART, and PGWCS CAUTION lamps are ON.
- 6.3.2.1.5 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.
- 6.3.2.2 Rupt Lock-Interrupt Too Long
- 6.3.2.2.1 On K-148 enter the following sequence
  - VERB 24 NOUN 01 ENTR
  - 01777 ENTR
  - 30001 ENTR
  - 01777 ENTR
  - VERB 25 NOUN 26 ENTR
  - 00001 ENTR
  - 01777 ENTR
  - 00003 ENTR
  - VERB 31 ENTR
- 6.3.2.2.2 Verify RESTART, and PGWCS CAUTION lamps are ON.
- 6.3.2.2.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.
- 6.3.2.3 TC Trap Test
- 6.3.2.3.1 On K-148 enter the following sequence
  - VERB 21 NOUN 01 ENTR
  - 01777 ENTR
  - 01777 ENTR
  - VERB 25 NOUN 26 ENTR
  - 04000 ENTR
  - 01777 ENTR
  - 00003 ENTR
  - VERB 30 ENTR
- 6.3.2.3.2 Verify RESTART, and PGWCS CAUTION lamps are ON.
- 6.3.2.3.3 On K-148 enter VERB 36 ENTR. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.2.4 Nightwatchman Test

6.3.2.4.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTER  
01777 ENTER  
30001 ENTER  
01777 ENTER  
VERB 25 NOUN 26 ENTER  
03400 ENTER  
01777 ENTER  
00003 ENTER  
VERB 30 ENTER

6.3.2.4.2 Verify RESTART, and POWCS CAUTION lamps are ON.

6.3.2.4.3 On K-148 enter VERB 36 ENTER. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.3 IMU OPERATE POWER ON TESTS

CAUTION

Prior to application of IMU OPERATE power in step 6.3.3.1.4, LOG OPERATE and IMU STANDBY power must have been applied to the G&N System continuously for a minimum of two hours. The only exception is when the requirements of step 6.2.4.10 are met and this does not apply for the initial application of IMU OPERATE power.

6.3.3.1 Verification of Power Turn-On

6.3.3.1.1 Set up analog recorder to monitor the following signals:

| SIGNAL NO. | SIGNAL NAME                     |
|------------|---------------------------------|
| a. GG 2136 | MG Servo Error Total            |
| b. GG 2106 | IG Servo Error Total            |
| c. GG 2166 | OG Servo Error Total            |
| d. GG 2112 | IG 1X Resolver Sine             |
| e. GG 2172 | OG 1X Resolver Sine             |
| f. GG 2142 | MG 1X Resolver Sine             |
| g. GG 1201 | IMU 28V 1 $\frac{1}{2}$ 800 cps |
| h. SPARE   |                                 |

6.3.3.1.2 Start analog recorder to a chart speed of 5 mm/sec. Start event recorder at a chart speed of 1.0 mm/sec. ( , , , , , ).

6.3.3.1.3 On CRT, monitor +120 VDC PIPA SUPPLY (GG 1040) and IMU gimbal angles.

6.3.3.1.4 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.3.3.1.5 Verify on analog recorder that the oscillations of the resolver sine signals (GG 2112, GG 2172, and GG 2142) are not sustained and that the signals damp out within 15 seconds. If they don't, remove IMU OPERATE power as soon as possible.



6.3.2.4 Nightwatchman Test

6.3.2.4.1 On K-148 enter the following sequence

VERB 24 NOUN 01 ENTER  
01777 ENTER  
30001 ENTER  
01777 ENTER  
VERB 25 NOUN 26 ENTER  
03400 ENTER  
01777 ENTER  
00003 ENTER  
VERB 30 ENTER

6.3.2.4.2 Verify RESTART, and POWCS CAUTION lamps are ON.

6.3.2.4.3 On K-148 enter VERB 36 ENTER. Press ERROR RESET pushbutton. All alarms shall clear.

6.3.3 IMU OPERATE POWER ON TESTS

CAUTION

Prior to application of IMU OPERATE power in step 6.3.3.1.4, IGC OPERATE and IMU STANDBY power must have been applied to the G&N System continuously for a minimum of two hours. The only exception is when the requirements of step 6.2.4.10 are met and this does not apply for the initial application of IMU OPERATE power.

6.3.3.1 Verification of Power Turn-On

6.3.3.1.1 Set up analog recorder to monitor the following signals:

| SIGNAL NO. | SIGNAL NAME          |
|------------|----------------------|
| a. GG 2136 | MG Servo Error Total |
| b. GG 2106 | IG Servo Error Total |
| c. GG 2166 | OG Servo Error Total |
| d. GG 2112 | IG 1X Resolver Sine  |
| e. GG 2172 | OG 1X Resolver Sine  |
| f. GG 2142 | MG 1X Resolver Sine  |
| g. GG 1201 | IMU 28V 14 800 cps   |
| h. SPARE   |                      |

6.3.3.1.2 Start analog recorder to a chart speed of 5 mm/sec. Start event recorder at a chart speed of 1.0 mm/sec.

6.3.3.1.3 On CRT, monitor +120 VDC FIPA SUPPLY (GG 1040) and IMU gimbal angles.

6.3.3.1.4 Press in +28 VDC IMU OPERATE circuit breaker on LEM Cabin Panel 11. Record time.

6.3.3.1.5 Verify on analog recorder that the oscillations of the resolver sine signals (GG 2112, GG 2172, and GG 2142) are not sustained and that the signals damp out within 15 seconds. If they don't, remove IMU OPERATE power as soon as possible.

- 6.3.3.1.6 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90 ± 10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.
- 6.3.3.1.7 On event recorder verify the following:  
LGC WARNING is OFF (GG 9001)  
ISS WARNING is OFF (GG 9002)  
PGNCS CAUTION is OFF (GG 9003)
- 6.3.3.1.8 On CRT, verify all IMU gimbal angles indicate between 358 and 002.
- 6.3.3.1.9 On K-148 enter the following sequence:  
VERB 41 NOUN 20 EWR  
+00000 EWR  
+00000 EWR  
+00000 EWR
- 6.3.4 Temperature Control Verification
- 6.3.4.1 When 15 minutes have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP (GG 2300).
- 6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIG TEMP (GG 2301).
- 6.3.4.3 When 1 hour has elapsed from the time of IMU OPERATE power turn-on, monitor PIPA TEMP (GG 2300) and IRIG TEMP (GG 2301) on the CRT. Monitor and record temperature readings every 5 minutes for one hour. Verify that each reading does not deviate from the average value of each signal by more than 0.1°F.
- 6.3.4.4 When 2 hours have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP and IRIG TEMP. The PIPA Temp shall be 130.5 (±1.5)°F. The IRIG TEMP shall be 135 (±2.5)°F.
- 6.3.4.5 The PIPA TEMP recorded in step 6.3.4.4 shall be within 0.5°F of temperature recorded in steps 6.3.4.1.5 and 6.3.4.1.
- 6.3.4.6 The IRIG TEMP recorded in step 6.3.4.4 shall be within 0.5°F of the temperature recorded in step 6.3.4.2.
- 6.3.5 PGNCS Power Supply Tests
- 6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.
- 6.3.5.2 The PIPA Calibration Module Temperature (GG 6020) shall be between +45 and +90 DEG F.
- 6.3.5.3 The PSA Temperature (GG 6021) shall be between +60 and +110 DEG F.

- 6.3.3.1.6 On the CRT, verify absence of +120 VDC PIPA SUPPLY voltage for 90 ± 10 seconds after step 6.3.3.1.4 is initiated. Verify that this voltage is between 114 and 126 after 100 seconds from step 6.3.3.1.4.
- 6.3.3.1.7 On event recorder verify the following:  
LOC WARNING is OFF (GG 9001)  
ISS WARNING is OFF (GG 9002)  
PGNCS CAUTION is OFF (GG 9003)
- 6.3.3.1.8 On CRT, verify all IMU gimbal angles indicate between 358 and 002.
- 6.3.3.1.9 On K-148 enter the following sequence:  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER
- 6.3.4 Temperature Control Verification
- 6.3.4.1 When 15 minutes have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP (GG 2300).
- 6.3.4.2 When 30 minutes have elapsed from the time of IMU OPERATE power turn-on record IRIQ TEMP (GG 2301).
- 6.3.4.3 When 1 hour has elapsed from the time of IMU OPERATE power turn-on, monitor PIPA TEMP (GG 2300) and IRIQ TEMP (GG 2301) on the CRT. Monitor and record temperature readings every 5 minutes for one hour. Verify that each reading does not deviate from the average value of each signal by more than 0.1°F.
- 6.3.4.4 When 2 hours have elapsed from the time of IMU OPERATE power turn-on record PIPA TEMP and IRIQ TEMP. The PIPA Temp shall be 130.5 (±1.5)°F. The IRIQ TEMP shall be 135 (±2.5)°F.
- 6.3.4.5 The PIPA TEMP recorded in step 6.3.4.4 shall be within 0.5°F of temperature recorded in steps 6.3.4.2 and 6.3.4.1.
- 6.3.4.6 The IRIQ TEMP recorded in step 6.3.4.4 shall be within 0.5°F of the temperature recorded in step 6.3.4.2.
- 6.3.5 PGNCS Power Supply Tests
- 6.3.5.1 From the CRT, confirm power supply voltages (or temperatures) are as specified and record values observed.
- 6.3.5.2 The PIPA Calibration Module Temperature (GG 6020) shall be between +45 and +90 DEG F.
- 6.3.5.3 The PSA Temperature (GG 6021) shall be between +60 and +110 DEG F.

- 6.3.5.4 The LOC Temperature (OG 4300) shall be between +45 and +130 DEG. F.
- 6.3.5.5 The +28 VDC IMU OPERATE BUS (OG 1500) shall be between 24.5 and 33.5 VDC.
- 6.3.5.6 The +28 VDC IMU STANDBY BUS (OG 1510) shall be between 24.5 and 33.5 VDC.
- 6.3.5.7 The +28 VDC LOC OPERATE BUS (OG 1520) shall be between 24.5 and 33.5 VDC.
- 6.3.5.8 The +120 VDC PIPA Supply (OG 1040) shall be between 114 and 126 VDC.
- 6.3.5.9 The -28VDC Supply (OG 1100) shall be between -21.5 and -33.5 VDC.
- 6.3.5.10 The +4VDC CPU Supply (OG 1070) shall be between 3.8 and 4.2 VDC.
- 6.3.5.11 The IMU 28V 800 PCS 1 pot Supply (OG 1201) shall be between 27.44 and 28.56 VRMS.
- 6.3.5.12 The IMU 28V 800 CPS 5 pot 90 PH Supply (OG 1202) shall be between 26.6 and 29.4 VRMS.
- 6.3.5.13 The IMU 28V 800 CPS 5 pot 0 PH Supply (OG 1203) shall be between 25.9 and 30.1 VRMS.
- 6.3.5.14 The 3.2 KC 28V Supply (OG 1331) shall be between 28.04 and 29.16 VRMS.
- 6.3.5.15 The 2.5 VDC T/M Bias (OG 1110) shall be between 2.4 and 2.6 VDC.
- 6.3.5.16 The +14 VDC LOC Supply (OG 1020) shall be between 13.8 and 14.2 VDC.
- 6.3.5.17 The +4 VDC LOC Supply (OG 1030) shall be between 3.85 and 4.15 VDC.
- 6.3.6 IMU OPERATIONAL TEST
- 6.3.6.1 On K-148 enter the following:  
  
 VERB 01 NOUN 10 ENTR  
 00003 ENTR  
 Record CRT DEKY Row 1 indication AAAAA and the time of day.
- 6.3.6.2 On K-148 enter the following:  
  
 VERB 21 NOUN 01 ENTR  
 01777 ENTR  
 AAAAA ENTR  
 VERB 06 NOUN 02 ENTR  
 01777 ENTR  
 Record CRT DEKY Row 1 indication as 1BBBB
- 6.3.6.3 Perform the following calculations:  
  
 a.  $\frac{BBBB \times 5.12}{3600} = CCCC.C$  (Contents (hrs) of high order scalar register)  
  
 b.  $23.3 - CCCC.C = DDDD.D$  hours

- 6.3.5.4 The LDC Temperature (GG 4300) shall be between +45 and +130 DEG. F.
- 6.3.5.5 The +28 VDC IMU OPERATE BUS (GG 1500) shall be between 24.5 and 33.5 VDC.
- 6.3.5.6 The +28 VDC IMU STANDBY BUS (GG 1510) shall be between 24.5 and 33.5 VDC.
- 6.3.5.7 The +28 VDC LDC OPERATE BUS (GG 1520) shall be between 24.5 and 33.5 VDC.
- 6.3.5.8 The +120 VDC PIPA Supply (GG 1040) shall be between 114 and 126 VDC.
- 6.3.5.9 The -28VDC Supply (GG 1100) shall be between -21.5 and -33.5 VDC.
- 6.3.5.10 The +4VDC CDU Supply (GG 1070) shall be between 3.8 and 4.2 VDC.
- 6.3.5.11 The IMU 28V 800 PCS 1 pct Supply (GG 1201) shall be between 27.44 and 28.56 VRMS.
- 6.3.5.12 The IMU 28V 800 CPS 5 pct 90 PH Supply (GG 1202) shall be between 26.6 and 29.4 VRMS.
- 6.3.5.13 The IMU 28V 800 CPS 5 pct 0 PH Supply (GG 1203) shall be between 25.9 and 30.1 VRMS.
- 6.3.5.14 The 3.2 MC 28V Supply (GG 1331) shall be between 28.04 and 29.16 VRMS.
- 6.3.5.15 The 2.5 VDC T/M Bias (GG 1110) shall be between 2.4 and 2.6 VDC.
- 6.3.5.16 The +14 VDC LDC Supply (GG 1020) shall be between 13.8 and 14.2 VDC.
- 6.3.5.17 The +4 VDC LDC Supply (GG 1030) shall be between 3.85 and 4.15 VDC.
- 6.3.6 IMU OPERATIONAL TEST
- 6.3.6.1 On K-148 enter the following:  
 VERB 01 NOUN 10 ENTR  
 00003 ENTR  
 Record CRT DEKY Row 1 indication AAAAA and the time of day.
- 6.3.6.2 On K-148 enter the following:  
 VERB 21 NOUN 01 ENTR  
 01777 ENTR  
 AAAAA ENTR  
 VERB 06 NOUN 02 ENTR  
 01777 ENTR  
 Record CRT DEKY Row 1 indication as +BBBBB
- 6.3.6.3 Perform the following calculations:  
 a.  $\frac{BBBBB \times 5.12}{3600} = CCCC.C$  (Contents (hrs) of high order scalar register)  
 b.  $23.3 - CCCC.C = DDDD.D$  hours

- c. DEED.D + time of day recorded in 6.3.6.1 = time of day at which high order scalar register will overflow.
- 6.3.6.4 If time of day is within 12 minutes of that calculated in 6.3.6.3.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.6.3.c has passed and proceed.
- 6.3.6.5 In K-148 enter the following sequence:  
VERB 57 ENTR  
00004 ENTR
- 6.3.6.6 Wait 2.0 seconds, then verify on the CRT, that the X, Y and Z PIPA SG Output signals all indicate 0.0  $\pm$  2.5 Volts but not 0.
- 6.3.6.7 Approximately 12 minutes after performing step 6.3.6.1, VERB 06 MOUN 66 shall flash.
- 6.3.6.8 From the CRT, DSKY display, read and record R1 and R2 (local gravity whole and fractional respectively). The value recorded shall be between 975.0 and 985.9 cm/sec<sup>2</sup>.
- 6.3.6.9 On K-148 enter the following sequence  
VERB 33 ENTR  
VERB 06 MOUN 66 shall flash.
- 6.3.6.10 From the CRT, DSKY display, read and record the horizontal fractional component of earth rate acting on the X, Y, and Z IRIG's as displayed in R2. The value recorded shall be between .77882 and .97882.
- 6.3.6.11 Terminate the test by entering in K-148 the following:  
VERB 36 ENTR  
VERB 41 MOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.3.7 FGCS Operational Test
- 6.3.7.1 Start the FGCS Operational test by inserting the following sequence into K-148:  
VERB 57 ENTR  
00010 ENTR  
Program 07 shall be displayed  
VERB 33 MOUN 01 is displayed flashing

- c. DDDD.D + time of day recorded in 6.3.6.1 = time of day at which high order scalar register will overflow.
- 6.3.6.4 If time of day is within 12 minutes of that calculated in 6.3.6.3.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.6.3.c has passed and proceed.
- 6.3.6.5 In K-148 enter the following sequence:  
VERB 57 ENTR  
00004 ENTR
- 6.3.6.6 Wait 200 seconds, then verify on the CRT, that the X, Y and Z FIPA SG Output signals all indicate 0.0  $\pm$ 2.5 Volts but not 0.
- 6.3.6.7 Approximately 12 minutes after performing step 6.3.6.1, VERB 06 NOUN 66 shall flash.
- 6.3.6.8 From the CRT, DSKY display, read and record R1 and R2 (local gravity whole and fractional respectively). The value recorded shall be between 975.0 and 985.9 cm/sec<sup>2</sup>.
- 6.3.6.9 On K-148 enter the following sequence  
VERB 33 ENTR  
VERB 06 NOUN 66 shall flash.
- 6.3.6.10 From the CRT, DSKY display, read and record the horizontal fractional component of earth rate acting on the X, Y, and Z IRIG's as displayed in R2. The value recorded shall be between .77882 and .97882.
- 6.3.6.11 Terminate the test by entering in K-148 the following:  
VERB 36 ENTR  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR
- 6.3.7 FGWCS Operational Test
- 6.3.7.1 Start the FGWCS Operational test by inserting the following sequence into K-148:  
VERB 57 ENTR  
00010 ENTR  
Program 07 shall be displayed  
VERB 33 NOUN 01 is displayed flashing

- 6.3.7.2 Command Accuracy 0°
- 6.3.7.2.1 On K-148, press ENTER  
 VERB 33 NOUN 02 is displayed flashing  
 Press ENTER  
 VERB 33 NOUN 03 is displayed flashing
- 6.3.7.2.2 Read and record the CRT IMU Gimbal angles. The indications shall be  $000 \pm 001$  degrees.
- 6.3.7.2.3 Read and record CRT the DSKY Rows 1, 2, and 3 indications. The indications shall be  $+00000 \pm 00007$ .
- 6.3.7.3 Command Accuracy 45°
- 6.3.7.3.1 On K-148, press ENTER, VERB 33 NOUN 04 is displayed flashing after approximately 20 seconds.
- 6.3.7.3.2 Read and record the CRT IMU Gimbal angle. The indications shall be  $045 \pm 001$  degrees.
- 6.3.7.3.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be  $+04500 \pm 00007$ .
- 6.3.7.4 CDU Repeating Accuracy 45°
- 6.3.7.4.1 On K-148 press ENTER. In about 90 seconds VERB 05 NOUN 30 is displayed flashing.
- 6.3.7.4.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.
- 6.3.7.5 Command Accuracy 90°
- 6.3.7.5.1 On K-148 Press VERB 33, ENTER. In approximately 20 seconds VERB 33 NOUN 06 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.5.2 Read and record the CRT IMU Gimbal angle. The indications shall be  $090 \pm 001$  degrees.
- 6.3.7.5.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be  $+09000 \pm 00007$ .
- 6.3.7.6 Command Accuracy 135°
- 6.3.7.6.1 On K-148 press ENTER. In approximately 20 seconds VERB 33 NOUN 07 is displayed flashing.



- 6.3.7.2 Command Accuracy 0°
- 6.3.7.2.1 On K-148, press ENTER  
 VERB 33 NOUN 02 is displayed flashing  
 Press ENTER  
 VERB 33 NOUN 03 is displayed flashing
- 6.3.7.2.2 Read and record the CRT IMU Gimbals angles. The indications shall be  $000 \pm 001$  degree.
- 6.3.7.2.3 Read and record CRT the DSKY Row 1, 2, and 3 indications. The indications shall be  $+00000 \pm 00007$ .
- 6.3.7.3 Command Accuracy 45°
- 6.3.7.3.1 On K-148, press ENTER, VERB 33 NOUN 04 is displayed flashing after approximately 20 seconds.
- 6.3.7.3.2 Read and record the CRT IMU Gimbals angle. The indications shall be  $045 \pm 001$  degrees.
- 6.3.7.3.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be  $+04500 \pm 00007$ .
- 6.3.7.4 CDU Repeating Accuracy 45°
- 6.3.7.4.1 On K-148 press ENTER. In about 90 seconds VERB 05 NOUN 30 is displayed flashing.
- 6.3.7.4.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.
- 6.3.7.5 Command Accuracy 90°
- 6.3.7.5.1 On K-148 Press VERB 33, ENTER. In approximately 20 seconds VERB 33 NOUN 06 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.5.2 Read and record the CRT IMU Gimbals angle. The indications shall be  $090 \pm 001$  degrees.
- 6.3.7.5.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be  $+09000 \pm 00007$ .
- 6.3.7.6 Command Accuracy 135°
- 6.3.7.6.1 On K-148 press ENTER. In approximately 20 seconds VERB 33 NOUN 07 is displayed flashing.

- 6.3.7.6.2 Read and record the CRT IMU Gimbal Angle indication. The indications shall be  $135 \pm 001$  degrees.
- 6.3.7.6.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be  $+13500 \pm 00007$ .
- 6.3.7.7 On K-148 press ENTER. In approximately 20 seconds VERB 33 NOUN 10 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall not be lighted.
- 6.3.7.8 CDU Repeating Accuracy  $135^\circ$ .
- 6.3.7.8.1 On K-148 press ENTER pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.
- 6.3.7.8.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.
- 6.3.7.9 + Gimbal Lock Test
- 6.3.7.9.1 On K-148, Press VERB 33, ENTER. In approximately 20 seconds VERB 33 NOUN 12 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.10 Command Accuracy  $225^\circ$ .
- 6.3.7.10.1 On K-148 press ENTER. In approximately 20 seconds, VERB 33, NOUN 13 is displayed flashing.
- 6.3.7.10.2 Read and record the CRT IMU Gimbal Angle indications. The indication shall be  $225 \pm 001$  degrees.
- 6.3.7.10.3 Read and record CRT DSKY Rows 1, 2, and 3 indications. The indications shall be  $+225^\circ 00 \pm 00007$ .
- 6.3.7.11 On K-148 press ENTER. In approximately 20 seconds VERB 33 NOUN 14 is displayed. The GIMBAL LOCK lamp shall not be lighted.
- 6.3.7.12 CDU Command Rate Test
- 6.3.7.12.1 On K-148 press ENTER. In approximately 30 seconds VERB 06 NOUN 66 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.12.2 Read and record the CRT DSKY Row 1, 2, and 3 indications. The indication shall be between 00012 and 00016.
- 6.3.7.12.3 On K-148 insert VERB 33 ENTER. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.
- 6.3.7.12.4 On K-148 insert VERB 33 ENTER. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on the DSKY shall not be lighted.

- 6.3.7.6.2 Read and record the CRT IMU Gimbal Angle indication. The indications shall be  $135 \pm 001$  degrees.
- 6.3.7.6.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be  $+13500 \pm 00007$ .
- 6.3.7.7 On K-148 press EWTR. In approximately 20 seconds VERB 33 NOUN 10 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall not be lighted.
- 6.3.7.8 CDU Repeating Accuracy  $135^\circ$ .
- 6.3.7.8.1 On K-148 press EWTR pushbutton. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.
- 6.3.7.8.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 7777<sup>4</sup> and 00003.
- 6.3.7.9 + Gimbal Lock Test
- 6.3.7.9.1 On K-148, Press VERB 33, EWTR. In approximately 20 seconds VERB 33 NOUN 12 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.10 Command Accuracy  $225^\circ$ .
- 6.3.7.10.1 On K-148 press EWTR. In approximately 20 seconds, VERB 33, NOUN 13 is displayed flashing.
- 6.3.7.10.2 Read and record the CRT IMU Gimbal Angle indications. The indication shall be  $225 \pm 001$  degrees.
- 6.3.7.10.3 Read and record CRT DSKY Rows 1, 2, and 3 indications. The indications shall be  $+22500 \pm 00007$ .
- 6.3.7.11 On K-148 press EWTR. In approximately 20 seconds VERB 33 NOUN 14 is displayed. The GIMBAL LOCK lamp shall not be lighted.
- 6.3.7.12 CDU Command Rate Test
- 6.3.7.12.1 On K-148 press EWTR. In approximately 30 seconds VERB 06 NOUN 66 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.12.2 Read and record the CRT DSKY Row 1, 2, and 3 indications. The indication shall be between 00012 and 00016.
- 6.3.7.12.3 On K-148 insert VERB 33 EWTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on DSKY shall not be lighted.
- 6.3.7.12.4 On K-148 insert VERB 33 EWTR. In approximately 30 seconds VERB 06 and NOUN 66 is displayed flashing. Repeat 6.3.7.12.2. The GIMBAL LOCK lamp on the DSKY shall not be lighted.

- 6.3.7.13 Command Accuracy 315°.
- 6.3.7.13.1 On K-148 insert VERB 33 ENTER. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.
- 6.3.7.13.2 Read and record CRT IMU Gimbal Angles: GIM. The indicator shall be 315 ± 001 degrees.
- 6.3.7.13.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be +31500 ± 00007.
- 6.3.7.14 CDU Repeating Accuracy 315°.
- 6.3.7.14.1 On K-148 press ENTER. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.
- 6.3.7.14.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.
- 6.3.7.15 -Gimbal Lock Test
- 6.3.7.15.1 On K-148 Press VERB 33 ENTER. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.16 CDU Repeating Accuracy 225°.
- 6.3.7.16.1 On K-148 press ENTER. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.
- 6.3.7.16.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be between 77774 and 00003.
- 6.3.7.17 On K-148 Press VERB 33 ENTER. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.
- 6.3.7.18 IMU CDU Fine Fail Test
- 6.3.7.18.1 On K-148 insert the following sequence  
+00100 ENTER  
+00100 ENTER  
+00100 ENTER  
On Event Module verify that ISS WARNING lamp lights.
- 6.3.7.18.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display Row 1 indicates 33XXX or 32XXX.

- 6.3.7.13 Command Accuracy 315°.
  - 6.3.7.13.1 On K-148 insert VERB 33 ENTER. In approximately 20 seconds VERB 33 NOUN 20 will be displayed flashing.
  - 6.3.7.13.2 Read and record CRT IMU Gimbal Angles: GYR. The indicator shall be  $315 \pm 001$  degrees.
  - 6.3.7.13.3 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be  $+31500 \pm 00007$ .
- 6.3.7.14 CDU Repeating Accuracy 315°.
  - 6.3.7.14.1 On K-148 press ENTER. In approximately 90 seconds VERB 05 NOUN 30 is displayed flashing.
  - 6.3.7.14.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indications shall be between 77774 and 00003.
- 6.3.7.15 Gimbal Lock Test
  - 6.3.7.15.1 On K-148 Press VERB 33 ENTER. In approximately 20 seconds VERB 33, NOUN 22 is displayed flashing. The GIMBAL LOCK lamp on DSKY shall be lighted.
- 6.3.7.16 CDU Repeating Accuracy 225°.
  - 6.3.7.16.1 On K-148 press ENTER. In about 90 seconds, VERB 05 NOUN 30 is displayed flashing.
  - 6.3.7.16.2 Read and record the CRT DSKY Rows 1, 2, and 3 indications. The indication shall be between 77774 and 00003.
- 6.3.7.17 On K-148 Press VERB 33 ENTER. The GIMBAL LOCK lamp shall not be lighted. VERB 21, NOUN 22 is displayed flashing.
- 6.3.7.18 IMU CDU Fine Fail Test
  - 6.3.7.18.1 On K-148 insert the following sequence
    - +00100 ENTER
    - +00100 ENTER
    - +00100 ENTER
 On Event Module verify that ISS WARNING lamp lights.
  - 6.3.7.18.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed. Verify that CRT DSKY display Row 1 indicates 33XXX or 32XXX.

6.3.7.19 DMU CDU Coarse Fail Test

6.3.7.19.1 On K-148 insert the following sequence

VERB 33 ENTER  
+03750 ENTER  
+03750 ENTER  
+03750 ENTER  
Verify that ISS WARNING lamp Event Module lights.

6.3.7.19.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed.  
Verify that CRT DECK display of Row 1 indicates 33XXX or 32XXX.

6.3.7.20 FDAI Linearity Test

6.3.7.20.1 On K-148 enter VERB 33 ENTER  
VERB 33 NOUN 27 shall be displayed.

6.3.7.20.2 On CRT verify the following:

PITCH ATT ERROR is between +15.3 and +18.7 DEG (OG 2219)  
YAW ATT ERROR is between +15.3 and +18.7 DEG (OG 2249)  
ROLL ATT ERROR is between +15.3 and +18.7 DEG (OG 2279)

6.3.7.20.3 On K-148 press ENTER.  
VERB 33 NOUN 30 shall be displayed.

6.3.7.20.4 On CRT verify the following:

PITCH ATT ERROR is between +14.4 and +17.6 DEG (OG 2219)  
YAW ATT ERROR is between +14.4 and +17.6 DEG (OG 2249)  
ROLL ATT ERROR is between +14.4 and +17.6 DEG (OG 2279)

6.3.7.20.5 On K-148 press ENTER.  
VERB 33 NOUN 31 shall be displayed

6.3.7.20.6 On CRT verify the following:

PITCH ATT ERROR is between +05.4 and +06.6 DEG (OG 2219)  
YAW ATT ERROR is between +05.4 and +06.6 DEG (OG 2249)  
ROLL ATT ERROR is between +05.4 and +06.6 DEG (OG 2279)

6.3.7.20.7 On K-148 press ENTER.  
VERB 33 NOUN 32 shall be displayed.

- 6.3.7.19 IMU CDU Coarse Fail Test
- 6.3.7.19.1 On K-148 insert the following sequence
  - VERB 33 ENTR
  - +03750 ENTR
  - +03750 ENTR
  - +03750 ENTR
  - Verify that ISS WARNING lamp Event Module lights.
- 6.3.7.19.2 After approximately 20 seconds, VERB 01 NOUN 10 shall be displayed.  
Verify that CRT DSKY display of Row 1 indicates 33XXX or 32XXX.
- 6.3.7.20 FMAI Linearity Test
- 6.3.7.20.1 On K-148 enter VERB 33 ENTR  
VERB 33 NOUN 27 shall be displayed.
- 6.3.7.20.2 On CRT verify the following:
  - PITCH ATT ERROR is between +15.3 and +18.7 DEG (GG 2219)
  - YAW ATT ERROR is between +15.3 and +18.7 DEG (GG 2249)
  - ROLL ATT ERROR is between +15.3 and +18.7 DEG (GG 2279)
- 6.3.7.20.3 On K-148 press ENTR.  
VERB 33 NOUN 30 shall be displayed.
- 6.3.7.20.4 On CRT verify the following:
  - PITCH ATT ERROR is between +14.4 and +17.6 DEG (GG 2219)
  - YAW ATT ERROR is between +14.4 and +17.6 DEG (GG 2249)
  - ROLL ATT ERROR is between +14.4 and +17.6 DEG (GG 2279)
- 6.3.7.20.5 On K-148 press ENTR.  
VERB 33 NOUN 31 shall be displayed.
- 6.3.7.20.6 On CRT verify the following:
  - PITCH ATT ERROR is between +05.4 and +06.6 DEG (GG 2219)
  - YAW ATT ERROR is between +05.4 and +06.6 DEG (GG 2249)
  - ROLL ATT ERROR is between +05.4 and +06.6 DEG (GG 2279)
- 6.3.7.20.7 On K-148 press ENTR.  
VERB 33 NOUN 32 shall be displayed.

- 6.3.7.20.8 On CRT verify the following:  
PITCH ATT ERROR is between +00.2 and -00.2 DEG (GG 2219)  
YAW ATT ERROR is between +00.2 and -00.2 DEG (GG 2249)  
ROLL ATT ERROR is between +00.2 and -00.2 DEG (GG 2279)
- 6.3.7.20.9 On K-148 press ENTER.  
VERB 33 NOUN 33 shall be displayed.
- 6.3.7.20.10 On CRT verify the following:  
PITCH ATT ERROR is between -05.4 and -06.6 DEG (GG 2219)  
YAW ATT ERROR is between -05.4 and -06.6 DEG (GG 2249)  
ROLL ATT ERROR is between -05.4 and -06.6 DEG (GG 2279)
- 6.3.7.20.11 On K-148 press ENTER.  
VERB 33 NOUN 34 shall be displayed.
- 6.3.7.20.12 On CRT verify the following:  
PITCH ATT ERROR is between -14.4 and -17.6 DEG (GG 2219)  
YAW ATT ERROR is between -14.4 and -17.6 DEG (GG 2249)  
ROLL ATT ERROR is between -14.4 and -17.6 DEG (GG 2279)
- 6.3.7.20.13 On K-148 press ENTER.  
VERB 33 NOUN 35 shall be displayed.
- 6.3.7.20.14 On CRT verify the following:  
PITCH ATT ERROR is between -15.3 and -18.7 DEG (GG 2219)  
YAW ATT ERROR is between -15.3 and -18.7 DEG (GG 2249)  
ROLL ATT ERROR is between -15.3 and -18.7 DEG (GG 2279)
- 6.3.7.21 On K-148 enter VERB 36 ENTER.  
The proper operation of the IMU GAGE function (consisting of steps 6.3.7.21 thru 6.3.7.23) need be performed only once during the initial PGWCS Operational Test and omitted from subsequent testing of test 6.3.7.
- 6.3.7.21.1 On K-148 enter the following sequence:  
VERB 41 NOUN 20 ENTER  
+00500 ENTER  
+00500 ENTER  
+00500 ENTER
- 6.3.7.21.2 On the CRT, verify all IMU gimbal angles indicate between 003 and 007 DEG.



- 6.3.7.20.8 On CRT verify the following:  
PITCH ATT ERROR is between +00.2 and -00.2 DEG (OG 2219)  
YAW ATT ERROR is between +00.2 and -00.2 DEG (OG 2249)  
ROLL ATT ERROR is between +00.2 and -00.2 DEG (OG 2279)
- 6.3.7.20.9 On K-148 press ENTER.  
VERB 33 NOUN 33 shall be displayed.
- 6.3.7.20.10 On CRT verify the following:  
PITCH ATT ERROR is between -05.4 and -06.6 DEG (OG 2219)  
YAW ATT ERROR is between -05.4 and -06.6 DEG (OG 2249)  
ROLL ATT ERROR is between -05.4 and -06.6 DEG (OG 2279)
- 6.3.7.20.11 On K-148 press ENTER.  
VERB 33 NOUN 34 shall be displayed.
- 6.3.7.20.12 On CRT verify the following:  
PITCH ATT ERROR is between -14.4 and -17.6 DEG (OG 2219)  
YAW ATT ERROR is between -14.4 and -17.6 DEG (OG 2249)  
ROLL ATT ERROR is between -14.4 and -17.6 DEG (OG 2279)
- 6.3.7.20.13 On K-148 press ENTER.  
VERB 33 NOUN 35 shall be displayed.
- 6.3.7.20.14 On CRT verify the following:  
PITCH ATT ERROR is between -15.3 and -18.7 DEG (OG 2219)  
YAW ATT ERROR is between -15.3 and -18.7 DEG (OG 2249)  
ROLL ATT ERROR is between -15.3 and -18.7 DEG (OG 2279)
- 6.3.7.21 On K-148 enter VERB 36 ENTER.  
The proper operation of the IMU CAGE function (consisting of steps 6.3.7.21 thru 6.3.7.23) need be performed only once during the initial PGMCB Operational Test and omitted from subsequent testing of test 6.3.7.
- 6.3.7.21.1 On K-148 enter the following sequence:  
VERB 41 NOUN 20 ENTER  
+00500 ENTER  
+00500 ENTER  
+00500 ENTER
- 6.3.7.21.2 On the CRT, verify all IMU gimbal angles indicate between 003 and 007 DEG.

6.3.7.21.3 On analog recorder, monitor the following signals:

| SIGNAL NO. | SIGNAL NAME          |
|------------|----------------------|
| a. GG 2136 | MG Servo Error Total |
| b. GG 2106 | IG Servo Error Total |
| c. GG 2166 | OG Servo Error Total |
| d. GG 2112 | IG LX Resolver Sine  |
| e. GG 2172 | OG LX Resolver Sine  |
| f. GG 2142 | MG LX Resolver Sine  |
| g. GG 1201 | IMU 28V 1 800 cps    |

6.3.7.21.4 Start analog recorder to a chart speed of 5 mm/sec.

6.3.7.21.5 On LEM Cabin Panel 4, hold IMU CAGE momentary toggle switch in the ON position. (Do not release).

6.3.7.21.6 On analog recorder, verify the LX Resolver Sine signals (GG 2112, GG 2172, GG 2142) null out to less than 0.5 VRMS. Release IMU CAGE switch to the OFF position. Disregard any momentary transients on the LX Resolver Sine signals when the switch is released. Any sustained oscillations shall be cause for immediate removal of IMU Operate power.

6.3.7.21.7 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.7.22 Stop analog recorder.

6.3.7.23 On K-148 enter the following sequence:

```

VERB 36 ENTR
VERB 41 NOUN 20 ENTR
+00700 ENTR
+00700 ENTR
+00700 ENTR

```

6.3.7.24 On CRT verify the following:

```

IG LX Resolver Sin (11°) is between +05.0 and +09.0 DEG (GG 2121)
MG LX Resolver Sin (11°) is between +05.0 and +09.0 DEG (GG 2151)
OG LX Resolver Sin (11°) is between +05.0 and +09.0 DEG (GG 2181)

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6.3.7.25 On K-148 enter the following:

```

VERB 41 NOUN 20 ENTR
+00000 ENTR
+00000 ENTR
+00000 ENTR

```

6.3.7.21.3 On analog recorder, monitor the following signals:

| SIGNAL NO. | SIGNAL NAME          |
|------------|----------------------|
| a. OG 2136 | MG Servo Error Total |
| b. OG 2106 | IG Servo Error Total |
| c. OG 2166 | OG Servo Error Total |
| d. OG 2112 | IG LX Resolver Sine  |
| e. OG 2172 | OG LX Resolver Sine  |
| f. OG 2142 | MG LX Resolver Sine  |
| g. OG 1201 | IMU 28V 14 800 cps   |

6.3.7.21.4 Start analog recorder to a chart speed of 5 mm/sec.

6.3.7.21.5 On LEM Cabin Panel 4, hold IMU CAGE momentary toggle switch in the ON position. (Do not release).

6.3.7.21.6 On analog recorder, verify the LX Resolver Sine signals (OG 2112, OG 2172, OG 2142) null out to less than 0.5 VRMS. Release IMU CAGE switch to the OFF position. Disregard any momentary transients on the LX Resolver Sine signals when the switch is released. Any sustained oscillations shall be cause for immediate removal of IMU Operate power.

6.3.7.21.7 On the CRT, verify all IMU gimbal angles indicate between 358 and 002.

6.3.7.22 Stop analog recorder.

6.3.7.23 On K-148 enter the following sequence:

|         |       |
|---------|-------|
| VERB 36 | ENTER |
| VERB 41 | ENTER |
| MOUW 20 | ENTER |
| +00700  | ENTER |
| +00700  | ENTER |
| +00700  | ENTER |

6.3.7.24 On CRT verify the following:

IG LX Resolver Sin (11°) is between +05.0 and +09.0 DEG (OG 2121)  
MG LX Resolver Sin (11°) is between +05.0 and +09.0 DEG (OG 2151)  
OG LX Resolver Sin (11°) is between +05.0 and +09.0 DEG (OG 2181)

6.3.7.25 On K-148 enter the following:

|         |         |       |
|---------|---------|-------|
| VERB 41 | MOUW 20 | ENTER |
| +00000  |         | ENTER |
| +00000  |         | ENTER |
| +00000  |         | ENTER |

- 6.3.8.7 If values for Row 1 and Row are correct, proceed to the next step.  
If values for Row 1 and Row 2 are incorrect, enter the following sequence into K-148:
- VERB 24 ENTR  
+XXXXX ENTR (Correct navigation base azimuth)  
+28.518 ENTR (Correct site latitude)  
Verify values in Row 1 and Row 2 are correct.
- 6.3.8.8 On K-148 enter the following sequence:
- VERB 33 ENTR (VERB 21 NOUN 30 shall flash)  
+00001 ENTR  
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.8.
- 6.3.8.9 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DESKY Row 1 (-X IRIG Scale Factor error in parts per million, Position +00001)
- 6.3.8.10 On K-148 enter the following sequence:
- VERB 33 ENTR (VERB 21 NOUN 30 shall flash)  
+00002 ENTR  
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.10.
- 6.3.8.11 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DESKY Row 1 (-Y IRIG Scale Factor error in parts per million, Position +00002).
- 6.3.8.12 On K-148 enter the following sequence:
- VERB 33 ENTR (VERB 21 NOUN 30 shall flash)  
+00003 ENTR  
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.12.
- 6.3.8.13 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DESKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position +00003).
- 6.3.8.14 On K-148 enter the following sequence:
- VERB 33 ENTR (VERB 21 NOUN 30 shall flash)  
+00001 ENTR  
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTR and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.14.
- 6.3.8.15 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DESKY Row (+X IRIG Scale Factor error in parts per million, Position -00001).

- 6.3.8.7 If values for Row 1 and Row are correct, proceed to the next step.  
If values for Row 1 and Row 2 are incorrect, enter the following sequence into K-148:
- VERB 24 ENTER  
+XXXXX ENTER (Correct navigation base azimuth)  
+28,516 ENTER (Correct site latitude)  
Verify values in Row 1 and Row 2 are correct.
- 6.3.8.8 On K-148 enter the following sequence:
- VERB 33 ENTER (VERB 21 NOUN 30 shall flash)  
+00001 ENTER  
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM is on, enter VERB 36 ENTER and repeat steps 6.3.8.3 through 6.3.8.8.
- 6.3.8.9 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (-X IRIG Scale Factor error in parts per million, Position +00001).
- 6.3.8.10 On K-148 enter the following sequence:
- VERB 33 ENTER (VERB 21 NOUN 30 shall flash)  
+00002 ENTER  
NOTE: If PROG lamp changes from 07 to 00 during next step or PROG ALARM lamp is on, enter VERB 36 ENTER and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.10.
- 6.3.8.11 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (-Y IRIG Scale Factor error in parts per million Position +00002).
- 6.3.8.12 On K-148 enter the following sequence:
- VERB 33 ENTER (VERB 21 NOUN 30 shall flash)  
+00003 ENTER  
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTER and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.12.
- 6.3.8.13 In approximately 200 seconds VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row 1 (+Z IRIG Scale Factor error in parts per million, Position +00003).
- 6.3.8.14 On K-148 enter the following sequence:
- VERB 33 ENTER (VERB 21 NOUN 30 shall flash)  
+00001 ENTER  
NOTE: If PROG lamp changes from 07 to 00 during the next step, or PROG ALARM lamp is on, enter VERB 36 ENTER and repeat steps 6.3.8.3 through 6.3.8.7 and 6.3.8.14.
- 6.3.8.15 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and record from CRT DSKY Row (+X IRIG Scale Factor error in parts per million, Position -00001).

- 6.3.8.16 On K-148 enter the following sequence:  
VERB 33 ENTER (VERB 21 NOUN 30 shall flash)  
-00002 ENTER  
NOTE: If PROG lamp changes from 07 to 00 during the next step, or  
PROG ALARM lamp is ON, enter VERB 36 ENTER and repeat steps  
6.3.8.3 through 6.3.8.7 and 6.3.8.16.
- 6.3.8.17 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and  
record from CRT DEK1 Row 1 (+Y IRIG Scale Factor error in parts per  
million, Position -00002).
- 6.3.8.18 On K-148 enter the following sequence:  
VERB 33 ENTER (VERB 21 NOUN 30 shall flash)  
-00003 ENTER  
NOTE: If PROG lamp changes from 07 to 00 during the next step, or  
PROG ALARM is ON, enter VERB 36 ENTER and repeat steps,  
6.3.8.3 through 6.3.8.7 and 6.3.8.18.
- 6.3.8.19 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and  
record from CRT DEK1 Row 1 (-Z IRIG Scale Factor error in parts per  
million, Position -00003).
- 6.3.8.20 Repeat steps 6.3.8.8 through 6.3.8.19 twice to obtain second and third  
set of data.
- 6.3.8.21 Terminate this test by entering in K-148 the following:  
VERB 34 ENTER  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER
- 6.3.8.22 The average of the three readings of Scale Factor Error for each of  
the 6 positions shall be  $0 \pm 1750$  PPM.
- 6.3.9 IMU performance Test. A reference data sheet is provided at the end  
of this section to aid in data reduction. Table II of the data sheet  
should be completed before the start of this test.
- 6.3.9.1 Insure that IMU Operate power and LOC Operate power has been applied  
for a minimum of one hour and that the IMU is not in a Gimbal Lock  
condition.
- 6.3.9.2 On CRT display, monitor and record IRIG TEMP (GG 2301) and PIPA TEMP  
(GG 2300).
- 6.3.9.3 Adjust oscilloscope to display butterfly of X PIPA.

- 6.3.8.16 On K-148 enter the following sequence:  
VERB 33 ENTER (VERB 21 NOUN 30 shall flash)  
-00002 ENTER  
NOTE: If PROG lamp changes from 07 to 00 during the next step, or  
PROG ALARM lamp is ON, enter VERB 36 ENTER and repeat steps  
6.3.8.3 through 6.3.8.7 and 6.3.8.16.
- 6.3.8.17 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and  
record from CRT DECK Row 1 (+Y IRIG Scale Factor error in parts per  
million, Position -00002).
- 6.3.8.18 On K-148 enter the following sequence:  
VERB 33 ENTER (VERB 21 NOUN 30 shall flash)  
-00003 ENTER  
NOTE: If PROG lamp changes from 07 to 00 during the next step, or  
PROG ALARM lamp is ON, enter VERB 36 ENTER and repeat steps,  
6.3.8.3 through 6.3.8.7 and 6.3.8.18.
- 6.3.8.19 In approximately 200 seconds, VERB 06 NOUN 66 shall flash. Read and  
record from CRT DECK Row 1 (-Z IRIG Scale Factor error in parts per  
million, Position -00003).
- 6.3.8.20 Repeat steps 6.3.8.8 through 6.3.8.19 twice to obtain second and third  
set of data.
- 6.3.8.21 Terminate this test by entering in K-148 the following:  
VERB 34 ENTER  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER
- 6.3.8.22 The average of the three readings of Scale Factor Error for each of  
the 6 positions shall be  $0 \pm 1750$  PPM.
- 6.3.9 IMU performance Test. A reference data sheet is provided at the end  
of this section to aid in data reduction. Table II of the data sheet  
should be completed before the start of this test.
- 6.3.9.1 Insure that IMU Operate power and LGC Operate power has been applied  
for a minimum of one hour and that the IMU is not in a Gimbal Lock  
condition.
- 6.3.9.2 On CRT display, monitor and record IRIG TEMP (GG 2301) and PIPA TEMP  
(GG 2300).
- 6.3.9.3 Adjust oscilloscope to display butterfly of X PIPA.

- 6.3.9.4 On K-148 enter the following:  
VERB 01 NOUN 10 ENTER  
00003 ENTER  
Record CRT DSKY Row 1 indication AAAAA and the time of day.
- 6.3.9.5 On K-148 enter the following:  
VERB 21 NOUN 01 ENTER  
01777 ENTER  
AAAAA ENTER  
VERB 06 NOUN 02 ENTER  
01777 ENTER  
Record CRT DSKY Row 1 indications as \$BBBBB.
- 6.3.9.6 Perform the following calculations:  
a.  $\frac{BBBBB \times 5.12}{360} = CCCC.C$  (Contents (hrs) of high order scalar register)  
b.  $23.3 - CCCC.C = DDDD.D$  hours.  
c.  $DDDD.D + \text{present time of day} = \text{time of day at which high order scalar register will overflow.}$
- 6.3.9.7 If the time of day is within 12 minutes of that calculated in 6.3.9.6.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.9.6.c has passed and proceed.  
  
Paragraph  
6.3.9.15  
6.3.9.22  
6.3.9.30  
6.3.9.36  
6.3.9.43  
6.3.9.48
- 6.3.9.8 On K-148 enter the following sequence:  
VERB 02 NOUN 01 ENTER  
00363 ENTER  
Record contents of Row 1 XXXXY  
VERB 21 NOUN 01 ENTER  
00363 ENTER  
XXXXY' ENTER  
Where Y' is obtained from Table IIA.  
VERB 57 ENTER  
00001 ENTER  
VERB 06 NOUN 61 shall flash
- 6.3.9.9 On the CRT, DSKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.



- 6.3.9.4 On K-148 enter the following:  
VERB 01 MOUN 10 ENTER  
00003 ENTER  
Record CRT DEKY Row 1 indication AAAAA and the time of day.
- 6.3.9.5 On K-148 enter the following:  
VERB 21 MOUN 01 ENTER  
01777 ENTER  
AAAAA ENTER  
VERB 06 MOUN 02 ENTER  
01777 ENTER  
Record CRT DEKY Row 1 indications as \*BBBBB.
- 6.3.9.6 Perform the following calculations:  
a.  $\frac{BBBBB \times 5.12}{360} = CCCC.C$  (Contents (hrs) of high order scalar register)  
b.  $23.3 - CCCC.C = DDDD.D$  hours.  
c.  $DDDD.D + \text{present time of day} = \text{time of day at which high order scalar register will overflow.}$
- 6.3.9.7 If the time of day is within 12 minutes of that calculated in 6.3.9.6.c when about to perform any of the following paragraphs, wait until that time calculated in 6.3.9.6.c has passed and proceed.
- Paragraph  
6.3.9.15  
6.3.9.22  
6.3.9.30  
6.3.9.36  
6.3.9.43  
6.3.9.48
- 6.3.9.8 On K-148 enter the following sequence:  
VERB 02 MOUN 01 ENTER  
00363 ENTER  
Record contents of Row 1 XXXXY  
VERB 21 MOUN 01 ENTER  
00363 ENTER  
XXXXY ENTER  
Where Y' is obtained from Table ILa.  
VERB 57 ENTER  
00001 ENTER  
VERB 06 MOUN 61 shall flash
- 6.3.9.9 On the CRT, DEKY display verify R1 (Navigation Base Azimuth) and R2 (Site Latitude) are correct.

- 6.3.9.10 If values for R1 and R2 are correct, proceed to next step.  
If values for R1 and R2 are incorrect, enter the following sequence into K-148.
- VERB 24 ENTER  
+xxx.xx ENTER (Correct navigation base azimuth  $\pm 0.50$  deg)  
+28.516 ENTER (Correct site latitude)  
Verify values in R1 and R2 are correct
- 6.3.9.11 On K-148 enter the following sequence:
- VERB 33 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.12 On CRT, DSKY display, verify R1 = +00600 (Time),  
R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position).  
If values for R1, R2 and R3 are correct, proceed to next step.  
If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- VERB 25 ENTER  
+00600 ENTER (Test Time in Seconds)  
+00000 ENTER (Test Index Number)  
+00001 ENTER (Test Position Entry)
- 6.3.9.13 On K-148 enter the following sequence:
- VERB 33 ENTER
- 6.3.9.14 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 (+NBDY Position +00001).
- 6.3.1.15 On K-148 enter the following sequence:
- VERB 33 ENTER
- 6.3.9.16 After 100 seconds, take a photograph of Y and Z PIPA butterfly patterns on oscilloscope.
- 6.3.9.17 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (+X PIPA Position +00001). Row 1 is whole part, Row 2 is fractional part. Units are cm/sec<sup>2</sup>.
- 6.3.9.18 On K-148 enter the following sequence:
- VERB 34 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.19 On CRT, DSKY display - verify R1 = +00600, R2 = +00000, and R3 = +00002
- 6.3.9.20 On K-148 enter the following sequence:
- VERB 33 ENTER

- 6.3.9.10 If values for R1 and R2 are correct, proceed to next step.  
If values for R1 and R2 are incorrect, enter the following sequence into K-148.
- VERB 24 ENTR  
ixxx.xx ENTR (Correct navigation base azimuth  $\pm 0.50$  deg)  
+28.516 ENTR (Correct site latitude)  
Verify values in R1 and R2 are correct
- 6.3.9.11 On K-148 enter the following sequence:
- VERB 33 ENTR  
VERB 06 NOUN 66 shall flash
- 6.3.9.12 On CRT, DSKY display, verify R1 = +00600 (Time),  
R2 = +00000 (Test Index No.) and R3 = +00001 (Test Position).  
If values for R1, R2 and R3 are correct, proceed to next step.  
If values for R1, R2 and R3 are incorrect, enter the following sequence into K-148:
- VERB 25 ENTR  
+00600 ENTR (Test Time in Seconds)  
+00000 ENTR (Test Index Number)  
+00001 ENTR (Test Position Entry)
- 6.3.9.13 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.3.9.14 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 (+NBDY Position +00001).
- 6.3.1.15 On K-148 enter the following sequence:
- VERB 33 ENTR
- 6.3.9.16 After 100 seconds, take a photograph of Y and Z PIPA butterfly patterns on oscilloscope.
- 6.3.9.17 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, record R1 and R2 (+X PIPA Position +00001). Row 1 is whole part, Row 2 is fractional part. Units are cm/sec<sup>2</sup>.
- 6.3.9.18 On K-148 enter the following sequence:
- VERB 34 ENTR  
VERB 06 NOUN 66 shall flash
- 6.3.9.19 On CRT, DSKY display - verify R1 = +00600, R2 = +00000, and R3 = +00002
- 6.3.9.20 On K-148 enter the following sequence:
- VERB 33 ENTR

- 6.3.9.21 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDZ Position +00002).
- 6.3.9.22 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.23 Approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-X PIPA Position +00002).
- 6.3.9.24 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.25 In approximately 67 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX + ADIAX Pos +00002).
- 6.3.9.26 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.27 On CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00003.
- 6.3.9.28 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.29 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX Position +00003).
- 6.3.9.30 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.31 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Z PIPA Position +00003).
- 6.3.9.32 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash.
- 6.3.9.33 On the CRT, DSKY display verify R1 = +00600, R2 = 00000, and R3 = +00004.
- 6.3.9.34 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.35 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDY + ADEGRAY Position +00004).

- 6.3.9.21 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDZ Position +00002).
- 6.3.9.22 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.23 Approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-X PIPA Position +00002).
- 6.3.9.24 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.25 In approximately 67 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX + ADIAX Pos +00002).
- 6.3.9.26 On K-148 enter the following sequence:  
VERB 34 ENTR  
VERB 06 NOUN 66 shall flash
- 6.3.9.27 On CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00003.
- 6.3.9.28 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.29 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (-NBDX Position +00003).
- 6.3.9.30 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.31 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Z PIPA Position +00003).
- 6.3.9.32 On K-148 enter the following sequence:  
VERB 34 ENTR  
VERB 06 NOUN 66 shall flash.
- 6.3.9.33 On the CRT, DSKY display verify R1 = +00600, R2 = 00000, and R3 = +00004.
- 6.3.9.34 On K-148 enter the following sequence:  
VERB 33 ENTR
- 6.3.9.35 In approximately 12 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+NBDY + ADISRAY Position +00004).

- 6.3.9.36 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.37 After 100 seconds, take a photograph of the X-PIPA butterfly pattern on oscilloscope.
- 6.3.9.38 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-Z PIPA Position +00004).
- 6.3.9.39 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.40 In approximately 67 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display record R2 (+NEDZ + ADIAZ Position +00004).
- 6.3.9.41 On K-148 enter the following sequence:  
VERB 33 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.42 From the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00005.
- 6.3.9.43 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.44 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.
- 6.3.9.45 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Y PIPA Position +00005).
- 6.3.9.46 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.47 On the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00006.
- 6.3.9.48 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.49 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.
- 6.3.9.50 In approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2. (-Y PIPA Position +00006).
- 6.3.9.51 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash

- 6.3.9.36 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.37 After 100 seconds, take a photograph of the X-PIPA butterfly pattern on oscilloscope.
- 6.3.9.38 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (-Z PIPA Position +00004).
- 6.3.9.39 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.40 In approximately 67 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display record R2 (+MBDZ + ADIAZ Position +00004).
- 6.3.9.41 On K-148 enter the following sequence:  
VERB 33 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.42 From the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00005.
- 6.3.9.43 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.44 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.
- 6.3.9.45 In approximately 5 minutes, VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2 (+Y PIPA Position +00005).
- 6.3.9.46 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.47 On the CRT, DSKY display verify R1 = +00600, R2 = +00000 and R3 = +00006.
- 6.3.9.48 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.49 The PROG alarm and GIMBAL LOCK lamps shall light. Press Error Reset.
- 6.3.9.50 In approximately 5 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R1 and R2. (-Y PIPA Position +00006).
- 6.3.9.51 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash

- 6.3.9.52 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000 and R3 = +00007.
- 6.3.9.53 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+.707 ADSRAX - NBDX Position +00007).
- 6.3.9.55 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.56 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00008.
- 6.3.9.57 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2  $-.707 (NBDZ + NBDY) + 0.5 (ADSRAY + ADSRAZ) + 0.5 (ADIAZ - ADIAX)$  (Position +00008).
- 6.3.9.59 On K-148 enter the following:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash..
- 6.3.9.60 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00009.
- 6.3.9.61 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display, record R2  $(-NBDZ + .707 ADSRAZ)$  Position +00009).
- 6.3.9.63 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.64 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00010.
- 6.3.9.65 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.66 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2  $[.707 (NBDY - NBDX) + .5 (ADIAZ - ADIAX) + .5 ADSRAX]$  (Position +00010).



- 6.3.9.52 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000 and R3 = +00007.
- 6.3.9.53 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.54 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 (+.707 ADSRAI - NBDX Position +00007).
- 6.3.9.55 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.56 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00008.
- 6.3.9.57 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.58 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display, record R2 -.707 (NBDZ+NBDY) +0.5 (ADIRAY + ADSRAZ) +0.5 (ADIAZ - ADIAX).
- 6.3.9.59 On K-148 enter the following:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash..
- 6.3.9.60 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00009.
- 6.3.9.61 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.62 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT DSKY display, record R2 (-NBDZ + .707 ADSRAZ Position +00009).
- 6.3.9.63 On K-148 enter the following sequence:  
VERB 34 ENTER  
VERB 06 NOUN 66 shall flash
- 6.3.9.64 On the CRT, DSKY display, verify R1 = +00600, R2 = +00000, and R3 = +00010.
- 6.3.9.65 On K-148 enter the following sequence:  
VERB 33 ENTER
- 6.3.9.66 In approximately 12 minutes VERB 06 NOUN 66 shall flash. From the CRT, DSKY display record R2 [-.707 (NBDY-NBDX) +.5 (ADIAZ - ADIAX) +.5 ADSRAZ] (Position +00010).

- 6.3.9.67 Terminate this test by entering in K-148 the following:  
VERB 36 ENTER
- 6.3.9.68 On CRT, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).
- 6.3.9.69 On K-148 enter the following sequence:  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER

6.3.9.67 Terminate this test by entering in K-148 the following:

VERB 36 ENTER

6.3.9.68 On CRT, record IRIG TEMP (CG 2301) and PIPA TEMP (CG 2300).

6.3.9.69 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER

## DATA SHEET

| ITEM NO. | PARAMETER                                                                             | UNITS               | RECORDED VALUE      |
|----------|---------------------------------------------------------------------------------------|---------------------|---------------------|
| 6.3.9.14 | +N BDY                                                                                | meru                | ( ) ---,--          |
| 6.3.9.17 | + X PIPA Test<br>Position +00001                                                      | cm/sec <sup>2</sup> | { } 00---,<br>----- |
| 6.3.9.21 | +N BDZ                                                                                | meru                | ( ) ---,--          |
| 6.3.9.23 | -X PIPA Test<br>Position +00002                                                       | cm/sec <sup>2</sup> | { } 00---,<br>----- |
| 6.3.9.25 | -N BIX + ADIAX<br>Position +00002                                                     | meru                | { } ---,--          |
| 6.3.9.29 | -N BIX                                                                                | meru                | ( ) ---,--          |
| 6.3.9.31 | +Z PIPA Test<br>Position +00003                                                       | cm/sec <sup>2</sup> | { } 00---,<br>----- |
| 6.3.9.35 | +N BDY + ADGRAY<br>Position +00004                                                    | meru                | ( ) ---,--          |
| 6.3.9.38 | -Z PIPA Test<br>Position +00004                                                       | cm/sec <sup>2</sup> | { } 00---,<br>----- |
| 6.3.9.40 | +N BDZ + ADIAZ<br>Position +00004                                                     | meru                | ( ) ---,--          |
| 6.3.9.45 | +Y PIPA Test<br>Position +00005                                                       | cm/sec <sup>2</sup> | { } 00---,<br>----- |
| 6.3.9.50 | -Y PIPA Test<br>Position +00006                                                       | cm/sec <sup>2</sup> | { } 00---,<br>----- |
| 6.3.9.54 | -NBIX + .707 ADGRAY<br>Position +00007                                                | meru                |                     |
| 6.3.9.58 | -.707 (NBDZ+NB DY)<br>+0.5 (ADIAZ-AD IAY)<br>+0.5 (ADGRAY+AD GRAZ)<br>Position +00008 | meru                |                     |
| 6.3.9.62 | -NBDE + .707 ADGRAZ<br>Position +00009                                                | meru                |                     |
| 6.3.9.66 | .707 (NB DY-NB IX)<br>+.5 (AD IAY-AD IAX)<br>+.5 ADGRAY<br>Position +00010            | meru                |                     |

## DATA SHEET

| ITEM NO.  | PARAMETER                                                                           | UNITS               | RECORDED VALUE      |
|-----------|-------------------------------------------------------------------------------------|---------------------|---------------------|
| 6.3.9. 14 | +N BDY                                                                              | m/su                | ( ) ---.---         |
| 6.3.9. 17 | +X PIPA Test<br>Position +00001                                                     | cm/sec <sup>2</sup> | { } 00---.<br>----- |
| 6.3.9. 21 | +N BDZ<br>Position +00002                                                           | m/su                | ( ) ---.---         |
| 6.3.9. 23 | -X PIPA Test<br>Position +00002                                                     | cm/sec <sup>2</sup> | { } 00---.<br>----- |
| 6.3.9. 25 | -N BIX + ADIAX<br>Position +00002                                                   | m/su                | { } ---.---         |
| 6.3.9. 29 | -N BIK<br>Position +00003                                                           | m/su                | ( ) ---.---         |
| 6.3.9. 31 | +Z PIPA Test<br>Position +00003                                                     | cm/sec <sup>2</sup> | { } 00---.<br>----- |
| 6.3.9. 35 | +N BDY + ADERAY<br>Position +00004                                                  | m/su                | ( ) ---.---         |
| 6.3.9. 38 | -Z PIPA Test<br>Position +00004                                                     | cm/sec <sup>2</sup> | { } 00---.<br>----- |
| 6.3.9. 40 | +N BDZ + ADIAZ<br>Position +00004                                                   | m/su                | ( ) ---.---         |
| 6.3.9. 45 | +Y PIPA Test<br>Position +00005                                                     | cm/sec <sup>2</sup> | { } 00---.<br>----- |
| 6.3.9. 50 | -Y PIPA Test<br>Position +00006                                                     | cm/sec <sup>2</sup> | { } 00---.<br>----- |
| 6.3.9. 54 | -NBIX + .707 ADERAX<br>Position +00007                                              | m/su                |                     |
| 6.3.9. 58 | -.707 (NBIZ+NB DY)<br>+0.5 (ADIAZ-ADIAY)<br>+0.5 (ADERAY+ADERAZ)<br>Position +00008 | m/su                |                     |
| 6.3.9. 62 | -NBIZ + .707 ADERAZ<br>Position +00009                                              | m/su                |                     |
| 6.3.9. 66 | .707 (NB DY-NBIX)<br>+.5 (ADIAY-ADIAX)<br>+.5 ADERAX<br>Position +00010             | m/su                |                     |

## DATA SHEET

| CALCULATION                                                                                                                                                                          | PARAMETER   | UNITS               |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------|----|
| line c - line f = ( ) ----<br>(-NBDX+ADIAZ)-(-NBDX)                                                                                                                                  | ADIAZ       | msr                 | q  |
| line h - line a = ( ) ----<br>(+NBDY+ADSRAY) - (+NBDY)                                                                                                                               | ADSRAY      | msr                 | r  |
| line j - line c = ( ) ----<br>(+NBDZ+ADIAZ) - (NBDZ)                                                                                                                                 | ADIAZ       | msr                 | s  |
| (line m - line f) X 1.414 = ( ) ----<br>(-NBDX + .707 ADSRAX)<br>-(-NBDX) X 1.414                                                                                                    | ADSRAX      | msr                 | t  |
| (line o + line c) X 1.414 = ( ) ----<br>(-NBDZ + .707 ADSRAZ + NBDZ) X 1.414                                                                                                         | ADSRAX      | msr                 | u  |
| (line p - .707 line a - .707 line f<br>+.5 line g -.5 line i) X 2 = ----<br>[.707 (NBDY-NBDX) +.5 (ADIAZ<br>-ADIAZ) +.5 ADSRAX -.707 (-NBDX) -.707 NBDY<br>+.5 ADIAZ -.5 ADSRAX] X 2 | ADIAZ       | msr                 | v  |
| line b - line d = ( )                                                                                                                                                                | PIPA X2G    | cm/sec <sup>2</sup> | w  |
| line k - line l = ( )                                                                                                                                                                | PIPA Y2G    | cm/sec <sup>2</sup> | x  |
| line g - line i = ( )                                                                                                                                                                | PIPA Z2G    | cm/sec <sup>2</sup> | y  |
| 1960.52 - line w X 1 cm/sec/pulse<br>Transfer results to line ay                                                                                                                     | X PIPA S.F. | cm/sec/<br>pulse    | z  |
| 1960.52 - line x X 1 cm/sec/pulse<br>Transfer results to line az                                                                                                                     | Y PIPA S.F. | cm/sec/<br>pulse    | aa |
| 1960.52 - line y X 1 cm/sec/pulse<br>Transfer results to line ba                                                                                                                     | Z PIPA S.F. | cm/sec/<br>pulse    | ab |
| 1/2 (line b + line d) = ( ) ----<br>Transfer results to line bb                                                                                                                      | X PIPA Bias | cm/sec <sup>2</sup> | ac |
| 1/2 (line k + line l) = ( ) ----<br>Transfer results to line bc                                                                                                                      | Y PIPA Bias | cm/sec <sup>2</sup> | ad |
| 1/2 (line g + line i) = ( ) ----<br>Transfer results to line bd                                                                                                                      | Z PIPA Bias | cm/sec <sup>2</sup> | ae |
| Perform the following calculations for values of NBD,<br>ADSRAX and ADIAZ. The constants are obtained from Table I.<br>Transfer results to items ap through ax on data sheet         |             |                     | af |

## DATA SHEET

| CALCULATION                                                                                                                                                                       | PARAMETER   | UNITS               |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------|----|
| line e - line f = ( ) ----<br>(-NBDX+ADIAZ)-(-NBDX)                                                                                                                               | ADIAZ       | neru                | q  |
| line h - line a = ( ) ----<br>(+NBDY+ADERAY) - (-NBDY)                                                                                                                            | ADERAY      | neru                | r  |
| line j - line c = ( ) ----<br>(+NBDZ+ADIAZ) - (-NBDZ)                                                                                                                             | ADIAZ       | neru                | s  |
| (line m - line f) X 1.414 = ( ) ----<br>(-NBDX + .707 ADERAX)<br>-(-NBDX) X 1.414                                                                                                 | ADERAX      | neru                | t  |
| (line o + line c) X 1.414 = ( ) ----<br>(-NBDZ + .707 ADERAZ + NBDZ) X 1.414                                                                                                      | ADERAZ      | neru                | u  |
| (line p - .707 line a -.707 line f<br>+.5 line q -.5 line t) X2 = ----<br>[.707 (NBDY-NBDX) +.5 (ADIAZ<br>-ADIAZ) +.5 ADERAX -.707 (-NBDX) -.707 NBDY<br>+.5 ADIAZ -.5 ADERAX] X2 | ADIAZ       | neru                | v  |
| line b - line d = ( )                                                                                                                                                             | PIPA X2G    | cm/sec <sup>2</sup> | v  |
| line k - line l = ( )                                                                                                                                                             | PIPA Y2G    | cm/sec <sup>2</sup> | x  |
| line g - line i = ( )                                                                                                                                                             | PIPA Z2G    | cm/sec <sup>2</sup> | y  |
| 1960.52 - line w X 1 cm/sec/pulse<br>Transfer results to line ay                                                                                                                  | X PIPA S.F. | cm/sec/<br>pulse    | z  |
| 1960.52 - line x X 1 cm/sec/pulse<br>Transfer results to line az                                                                                                                  | Y PIPA S.F. | cm/sec/<br>pulse    | aa |
| 1960.52 - line y X 1 cm/sec/pulse<br>Transfer results to line ba                                                                                                                  | Z PIPA S.F. | cm/sec/<br>pulse    | ab |
| 1/2 (line b + line d) = ( ) ----<br>Transfer results to line bb                                                                                                                   | X PIPA Bias | cm/sec <sup>2</sup> | ac |
| 1/2 (line k + line l) = ( ) ----<br>Transfer results to line bc                                                                                                                   | Y PIPA Bias | cm/sec <sup>2</sup> | ad |
| 1/2 (line g + line i) = ( ) ----<br>Transfer results to line bd                                                                                                                   | Z PIPA Bias | cm/sec <sup>2</sup> | ae |
| Perform the following calculations for values of NBD,<br>ADERA and ADIA. The constants are obtained from Table I.<br>Transfer results to items ap through ax on data sheet        |             |                     | af |

DATA SHEET

| CALCULATION                          | PARAMETER | UNITS |    |
|--------------------------------------|-----------|-------|----|
| WBDY = line a - WBDY<br>WBDY =       |           | WBU   | ag |
| WBDZ = line c - WBDZ<br>WBDZ =       |           | WBU   | ah |
| WBDX = (-line f) - WBDX<br>WBDX =    |           | WBU   | ai |
| ADYAX = line g - ADYAX<br>ADYAX =    |           | WBU   | aj |
| ADGRAY = line r - ADGRAY<br>ADGRAY = |           | WBU   | ak |
| ADIAZ = line s - ADIAZ<br>ADIAZ =    |           | WBU   | al |
| ADGRAX = line t - ADGRAX<br>ADGRAX = |           | WBU   | am |
| ADGRAX = line n - ADGRAZ<br>ADGRAZ = |           | WBU   | an |
| ADYAY = line v - ADYAY<br>ADYAY =    |           | WBU   | ao |



DATA SHEET

| CALCULATION                          | PARAMETER | UNITS |    |
|--------------------------------------|-----------|-------|----|
| NBDY = line a - NBDY<br>NBDY =       |           | metu  | ag |
| NBDZ = line c - NBDZ<br>NBDZ =       |           | metu  | ah |
| NBDX = (-line f) - NBDX<br>NBDX =    |           | metu  | ai |
| ADYAX = line q - ADYAX<br>ADYAX =    |           | metu  | aj |
| ADSRAY = line r - ADSRAY<br>ADSRAY = |           | metu  | ak |
| ADIAZ = line s - ADIAZ<br>ADIAZ =    |           | metu  | al |
| ADSRAX = line t - ADSRAX<br>ADSRAX = |           | metu  | am |
| ADSRAX = line u - ADSRAZ<br>ADSRAX = |           | metu  | an |
| ADIAZ = line v - ADIAZ<br>ADIAZ =    |           | metu  | ao |

## DATA SHEET

| PARAMETER                   | UNITS               | MIN<br>VALUE | RECORDED VALUE | MAX<br>VALUE | REJ | ACC |
|-----------------------------|---------------------|--------------|----------------|--------------|-----|-----|
| $\Delta$ NBDY               | neru                | -5.0         |                | +5.0         |     |     |
| $\Delta$ NBDZ               | neru                | -5.0         |                | +5.0         |     |     |
| $\Delta$ NBDK               | neru                | -5.0         |                | +5.0         |     |     |
| $\Delta$ ADSRAY             | neru                | -10.0        |                | +10.0        |     |     |
| $\Delta$ ADSRAZ             | neru                | -10.0        |                | +10.0        |     |     |
| $\Delta$ ADSRAX             | neru                | -10.0        |                | +10.0        |     |     |
| $\Delta$ ADLAX              | neru                | -15.0        |                | +15.0        |     |     |
| $\Delta$ ADLAZ              | neru                | -15.0        |                | +15.0        |     |     |
| $\Delta$ ADLAY              | neru                | -15.0        |                | +15.0        |     |     |
| X PIPA S.F.<br>from line z  | cm/sec<br>/pulse    | .9996        |                | 1.0004       |     |     |
| Y PIPA S.F.<br>from line aa | cm/sec<br>/pulse    | .9996        |                | 1.0004       |     |     |
| Z PIPA S.F.<br>from line ab | cm/sec<br>/pulse    | .9996        |                | 1.0004       |     |     |
| X PIPA Bias<br>from line ac | cm/sec <sup>2</sup> | -0.5         |                | +0.5         |     |     |
| Y PIPA Bias<br>from line ad | cm/sec <sup>2</sup> | -0.5         |                | +0.5         |     |     |
| Z PIPA Bias<br>from line ae | cm/sec <sup>2</sup> | -0.5         |                | +0.5         |     |     |

ap  
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av  
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ax  
ay  
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ba  
bb  
bc  
bd

DATA SHEET

| PARAMETER                   | UNITS               | MIN<br>VALUE | RECORDED VALUE | MAX<br>VALUE | REJ | ACC |
|-----------------------------|---------------------|--------------|----------------|--------------|-----|-----|
| $\Delta$ NBDY               | neru                | -5.0         |                | +5.0         |     |     |
| $\Delta$ NBDZ               | neru                | -5.0         |                | +5.0         |     |     |
| $\Delta$ NBDX               | neru                | -5.0         |                | +5.0         |     |     |
| $\Delta$ ADSRAY             | neru                | +10.0        |                | +10.0        |     |     |
| $\Delta$ ADSRAZ             | neru                | -10.0        |                | +10.0        |     |     |
| $\Delta$ ADSRAX             | neru                | -10.0        |                | +10.0        |     |     |
| $\Delta$ ADIAX              | neru                | -15.0        |                | +15.0        |     |     |
| $\Delta$ ADIAZ              | neru                | -15.0        |                | +15.0        |     |     |
| $\Delta$ ADIAX              | neru                | -15.0        |                | +15.0        |     |     |
| X PIPA S.F.<br>from line a  | cm/sec<br>/pulse    | .9996        |                | 1.0004       |     |     |
| Y PIPA S.F.<br>from line aa | cm/sec<br>/pulse    | .9996        |                | 1.0004       |     |     |
| Z PIPA S.F.<br>from line ab | cm/sec<br>/pulse    | .9996        |                | 1.0004       |     |     |
| X PIPA Bias<br>from line ac | cm/sec <sup>2</sup> | -0.5         |                | +0.5         |     |     |
| Y PIPA Bias<br>from line ad | cm/sec <sup>2</sup> | -0.5         |                | +0.5         |     |     |
| Z PIPA Bias<br>from line ae | cm/sec <sup>2</sup> | -0.5         |                | +0.5         |     |     |

ap  
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bc  
bd

| JEC   | PARAMETER | VALUE |
|-------|-----------|-------|
| 16236 | BIX       |       |
| 16236 | ADSRAX    |       |
| 16237 | ADIAK     |       |
| 16239 | BDY       |       |
| 16239 | ADSRAY    |       |
| 16240 | ADLAY     |       |
| 16242 | BDE       |       |
| 16242 | ADSRAX    |       |
| 16243 | ADIAZ     |       |

TABLE II

| Y | Y' |
|---|----|
| 0 | 2  |
| 1 | 3  |
| 2 | 2  |
| 3 | 3  |
| 4 | 6  |
| 5 | 7  |
| 6 | 6  |
| 7 | 7  |

TABLE IIA

TABLE I

| JDC   | PARAMETER | VALUE |
|-------|-----------|-------|
| 16236 | BIM       |       |
| 16236 | ADSRAX    |       |
| 16237 | ADLAX     |       |
| 16239 | BDY       |       |
| 16239 | ADSRAY    |       |
| 16240 | ADLAY     |       |
| 16242 | BDE       |       |
| 16242 | ADSRAX    |       |
| 16243 | ADLAX     |       |

TABLE II

| Y | Y' |
|---|----|
| 0 | 2  |
| 1 | 3  |
| 2 | 2  |
| 3 | 3  |
| 4 | 6  |
| 5 | 7  |
| 6 | 6  |
| 7 | 7  |

TABLE IIA

- 6.3.10 LGC Voltage Margin Test
- 6.3.10.1 Initial Conditions
- 6.3.10.1.1 Insure that the G&N System is in Operate Mode.
- 6.3.10.1.2 On the CRT, verify the +28 VDC LGC OPERATE bus is between 24.5 and 33.5 vdc (GG 1520).
- 6.3.10.2 Voltage Margin Determination
- 6.3.10.2.1 On the PSA Adapter Module (PSAAM) (410-31080), place INHIBIT VOLTAGE FAIL switch to ON.
- CAUTION:** The +4 vdc LGC Supply voltage shall never be operated lower than +2.5 vdc or higher than +5.2 vdc (GG 1030).
- The +14 vdc LGC Supply shall never be operated less than +8.5 vdc or higher than +17.0 vdc (GG 1020).
- NOTE:** The flashing indication of the LGC supplies may be disregarded for this test. The charts in Table III may be used to determine approximate values for the "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.
- 6.3.10.2.2 Enter 0001 into R155. Verify and execute.
- 6.3.10.2.3 Enter 1111 into R154. Verify and execute.
- 6.3.10.2.4 Enter in C-156 +XX.XX01114. (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 12.1 (+0.3, -0) vdc. See Table III. Execute.
- 6.3.10.2.5 Enter in C-156 +XX.XX01124 (Enter a value for XX.X which will adjust the +4V power supply (GG 1030) as monitored on the CRT, to 3.5 (+0.15, -0) vdc. See Table III. Execute.
- 6.3.10.2.6 On K-148 press ERROR RESET.
- 6.3.10.2.7 On K-148 initiate LGC Self-Check by entering the following:
- VERB 21 NOUN 27 ENTER  
77767 ENTER
- Wait 200 seconds. Verify RESTART lamp on the DSKY is not lit.
- 6.3.10.2.8 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.
- 6.3.10.2.9 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:
- VERB 21 NOUN 27 ENTER  
77767 ENTER

## 6.3.10 LGC Voltage Margin Test

## 6.3.10.1 Initial Conditions

6.3.10.1.1 Insure that the G&amp;N System is in Operate Mode.

6.3.10.1.2 On the CRT, verify the +28 VDC LOC OPERATE bus is between 24.5 and 33.5 vdc (GG 1520).

## 6.3.10.2 Voltage Margin Determination

6.3.10.2.1 On the PSA Adapter Module (PSAAM) (410-31080), place INHIBIT VOLTAGE FAIL switch to ON.

**CAUTION:** The +4 vdc LOC Supply voltage shall never be operated lower than +2.5 vdc or higher than +5.2 vdc (GG 1030).

The +14 vdc LOC Supply shall never be operated less than +8.5 vdc or higher than +17.0 vdc (GG 1020).

**NOTE:** The flashing indication of the LOC supplies may be disregarded for this test. The charts in Table III may be used to determine approximate values for the "XX.X" values of C-156 voltage dial settings corresponding to various power supply voltages.

6.3.10.2.2 Enter 0001 into R155. Verify and execute.

6.3.10.2.3 Enter 1111 into R154. Verify and execute.

6.3.10.2.4 Enter in C-156 ±XX.X001114. (Enter a value for XX.X which will adjust the +14V power supply (GG 1020) as monitored on the CRT, to 12.1 (+0.3, -0) vdc. See Table III. Execute.

6.3.10.2.5 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the +4V power supply (GG 1030) as monitored on the CRT, to 3.5 (+0.15, -0) vdc. See Table III. Execute.

6.3.10.2.6 On K-148 press ERROR RESET.

6.3.10.2.7 On K-148 initiate LOC Self-Check by entering the following:

VERB 21 NOUN 27 ENTER  
77767 ENTER

Wait 200 seconds. Verify RESTART lamp on the DSKY is not lit.

6.3.10.2.8 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.

6.3.10.2.9 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:

VERB 21 NOUN 27 ENTER  
77767 ENTER

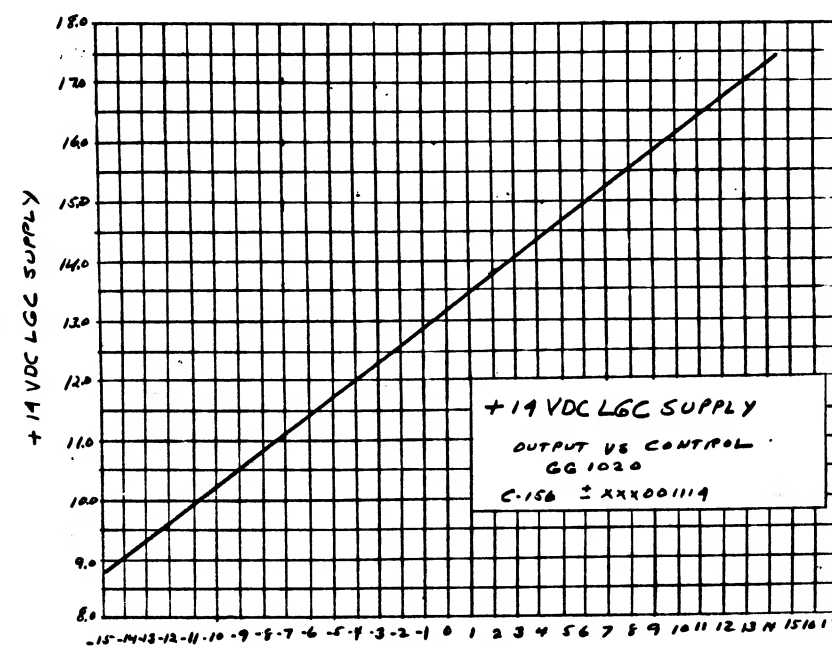
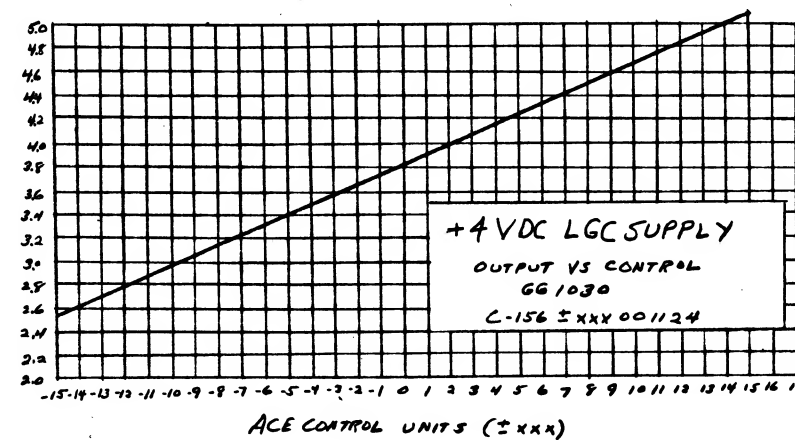
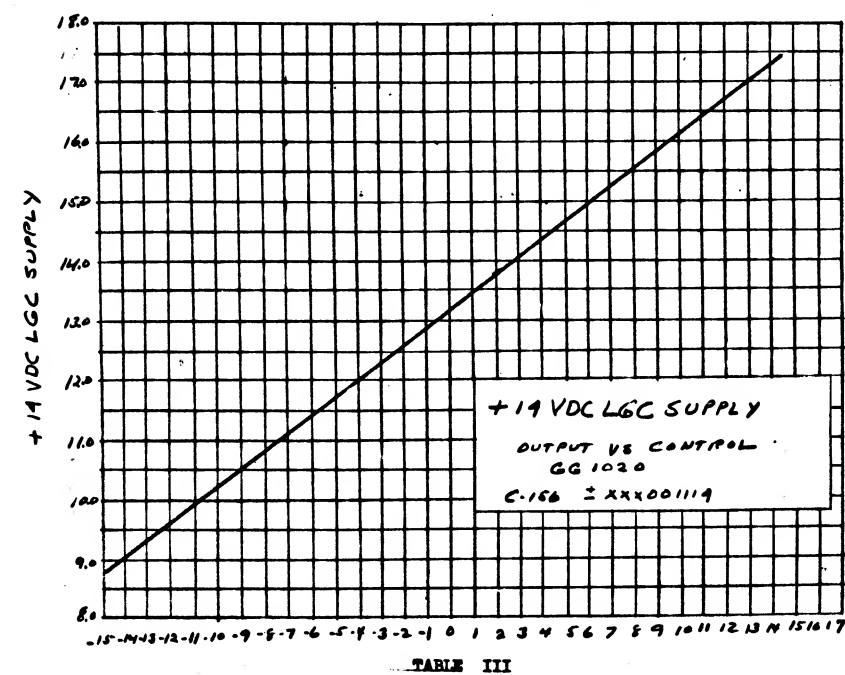
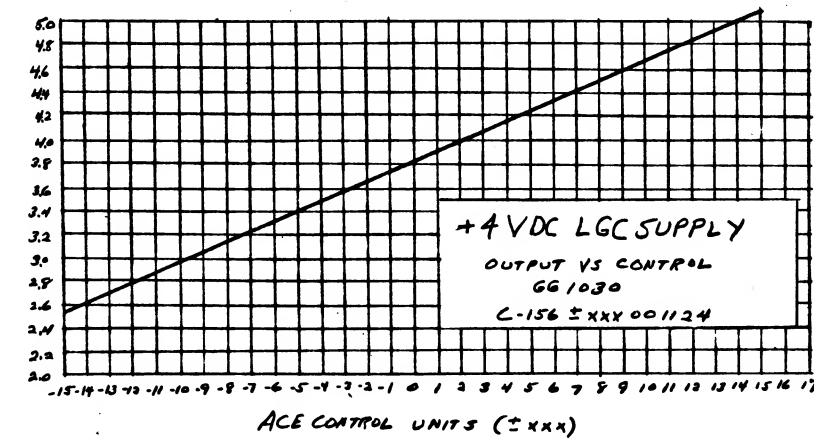


TABLE III





- 6.3.10.2.10 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the +14V power supply (OG 1020) as monitored on the CRT, to 16.4 (+0, -0.4) vdc. See Table III. Execute.
- 6.3.10.2.11 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.
- 6.3.10.2.12 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:
- VERB 21 NOUN 27 ENTER  
77767 ENTER
- 6.3.10.2.13 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the 4V power supply (OG 1030) as monitored on the CRT, to 4.5 (+0, -0.2) vdc. See Table III. Execute.
- 6.3.10.2.14 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.
- 6.3.10.2.15 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL Switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:
- VERB 21 NOUN 27 ENTER  
77767 ENTER
- 6.3.10.2.16 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the 14V power supply (OG 1020) as monitored on the CRT, to 12.1 (+0.3, -0) vdc. See Table III. Execute.
- 6.3.10.2.17 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.
- 6.3.10.2.18 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.
- 6.3.10.2.19 On R-154 enter 0000. Execute.
- 6.3.10.2.20 On R-155 enter 0000. Execute.
- 6.3.10.2.21 On K-148 terminate the LQC Self-Check by entering the following:
- VERB 21 NOUN 27 ENTER  
00000 ENTER
- 6.3.10.2.22 On K-148 press ERROR RESET.

- 6.3.10.2.10 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the +14V power supply (OG 1020) as monitored on the CRT, to 16.4 (+0, -0.4) vdc. See Table III. Execute.
- 6.3.10.2.11 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.
- 6.3.10.2.12 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:
- VERB 21 NOUN 27 ENTER  
77767 ENTER
- 6.3.10.2.13 Enter in C-156 ±XX.X001124 (Enter a value for XX.X which will adjust the 4V power supply (OG 1030) as monitored on the CRT, to 4.5 (+0, -0.2) vdc. See Table III. Execute.
- 6.3.10.2.14 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lit.
- 6.3.10.2.15 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL Switch to OFF. Verify RESTART lamp on the DSKY is lit. Set the INHIBIT VOLTAGE FAIL switch to ON. Press ERROR RESET. Perform the following DSKY operations:
- VERB 21 NOUN 27 ENTER  
77767 ENTER
- 6.3.10.2.16 Enter in C-156 (±) XX.X001114 (Enter a value for XX.X which will adjust the 14V power supply (OG 1020) as monitored on the CRT, to 12.2 (+0.3, -0) vdc. See Table III. Execute.
- 6.3.10.2.17 On K-148 press ERROR RESET. Wait 200 seconds. Verify RESTART lamp on DSKY is not lighted.
- 6.3.10.2.18 On the PSA Adapter Module place INHIBIT VOLTAGE FAIL switch to OFF. Verify RESTART lamp on the DSKY is lighted.
- 6.3.10.2.19 On R-154 enter 0000. Execute.
- 6.3.10.2.20 On R-155 enter 0000. Execute.
- 6.3.10.2.21 On K-148 terminate the LGC Self-Check by entering the following:
- VERB 21 NOUN 27 ENTER  
00000 ENTER
- 6.3.10.2.22 On K-148 press ERROR RESET.

- 6.3.11 LGC Clock Frequency Test
- 6.3.11.1 Insure that LGC Operate power has been applied for a minimum of 10 minutes before performing this test.
- 6.3.11.2 Verify that the counter is connected to the 3.2 kc signal on the hardline.
- 6.3.11.3 Insure that the counter has been warming up for a minimum of 30 minutes.
- 6.3.11.4 On the counter,  
Set the FUNCTION switch to: MAN START  
Set the TIME BASE switch to: 1  $\mu$ sec TIME UNIT/COUNT  
Set the SENSITIVITY control to: CHECK
- 6.3.11.5 Verify proper counter operation.
- 6.3.11.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.
- 6.3.11.7 Plug in the Preset unit and set:  
MODE switch to PRESET  
N switches to 96000
- 6.3.11.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.
- 6.3.11.9 Start counting by depressing RESET switch on counter.
- 6.3.11.10 After approximately 30 seconds, read and record counter display.
- 6.3.11.11 Repeat steps 6.3.11.9 and 6.3.11.10 9 times.
- 6.3.11.12 The average of the 10 previous readings shall be 30.000000 $\pm$ 0.000060 seconds.
- 6.3.11.13 Insure that the System is not in IMU Operate.
- 6.3.11.14 Perform the following DEKY operations.  
VERB 21 MOUN 10 ENTER  
00013 ENTER  
02000 ENTER  
Press and hold the STBY pushbutton on the DEKY for 3 seconds. Verify the Standby lamp is lighted.
- 6.3.11.15 Repeat steps 6.3.11.9 through 6.3.11.12.
- 6.3.11.16 Press and hold the STBY pushbutton on the DEKY for 3 seconds. Verify the Standby lamp is not lighted.

- 6.3.11 LGC Clock Frequency Test
- 6.3.11.1 Insure that LGC Operate power has been applied for a minimum of 10 minutes before performing this test.
- 6.3.11.2 Verify that the counter is connected to the 3.2 kc signal on the hardline.
- 6.3.11.3 Insure that the counter has been warming up for a minimum of 30 minutes.
- 6.3.11.4 On the counter,  
Set the FUNCTION switch to: MAN START  
Set the TIME BASE switch to: 1.0000 TIME UNIT/COUNT  
Set the SENSITIVITY control to: CHECK
- 6.3.11.5 Verify proper counter operation.
- 6.3.11.6 Set the FUNCTION switch to REMOTE OR TIME INTERVAL.
- 6.3.11.7 Plug in the Preset unit and set:  
MODE switch to PRESET  
H switches to 96'00
- 6.3.11.8 Turn SAMPLE RATE control fully clockwise (HOLD). Wait 35 seconds for counter display to fill.
- 6.3.11.9 Start counting by depressing RESET switch on counter.
- 6.3.11.10 After approximately 30 seconds, read and record counter display.
- 6.3.11.11 Repeat steps 6.3.11.9 and 6.3.11.10 9 times.
- 6.3.11.12 The average of the 10 previous readings shall be 30.000000±0.000060 seconds.
- 6.3.11.13 Insure that the System is not in INU Operate.
- 6.3.11.14 Perform the following DSKY operations.  
VERB 21 HOUN 10 EWTR  
00013 EWTR  
02000 EWTR  
Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is lighted.
- 6.3.11.15 Repeat steps 6.3.11.9 through 6.3.11.12.
- 6.3.11.16 Press and hold the STBY pushbutton on the DSKY for 3 seconds. Verify the Standby lamp is not lighted.

- 6.3.11.17 On the Computer Control and Reticule dimmer assembly, press and hold MARK X pushbutton.
- 6.3.11.18 On the DSKY observe  
 VERB 05 MOUN 31  
 Row 1 = 00112  
 Prog Alarm lamp is lighted  
 Press ERR RESET
- 6.3.11.19 Enter the following on K-148  
 VERB 11 MOUN 10 ENTER  
 00016 ENTER
- 6.3.11.20 Observe that DSKY Row 1 displays 00004.
- 6.3.11.21 Release MARK X pushbutton
- 6.3.11.22 Observe that DSKY Row 1 displays 00000.
- 6.3.11.23 Press and hold the MARK Y pushbutton on the Computer Control and Reticule Dimmer Assembly.
- 6.3.11.24 Observe that DSKY Row 1 displays 00010.
- 6.3.11.25 Release MARK Y pushbutton.
- 6.3.11.26 Observe that DSKY Row 1 displays 00000.
- 6.3.11.27 Press and hold the REJECT pushbutton on the Computer Control and Reticule Dimmer Assembly.
- 6.3.11.28 Observe that DSKY Row 1 displays 00020.
- 6.3.11.29 Release the REJECT pushbutton.
- 6.3.11.30 Observe that DSKY Row 1 displays 00000.
- 6.3.11.31 On the DSKY perform the following operation:  
 VERB 36 ENTER
- 6.3.11.32 On the Computer Control and Reticule dimmer assembly, rotate the RETICLE BRIGHTNESS control to its minimum light intensity position. View through the AOT and verify that the reticle lamp is off.
- 6.3.11.33 While viewing through the AOT, slowly rotate the RETICLE BRIGHTNESS control to increase the reticle brightness until a stop is reached. Observe that the reticle brightness has increased in intensity. Return RETICLE BRIGHTNESS control to off state.

- 6.3.11.17 On the Computer Control and Reticule dimmer assembly, press and hold MARK X pushbutton.
- 6.3.11.18 On the DSKY observe  
 VERB 05 NOUN 31  
 Row 1 - 00112  
 Prog Alarm lamp is lighted  
 Press ERR RSET
- 6.3.11.19 Enter the following on K-148  
 VERB 11 NOUN 10 ENTER  
 00016 ENTER
- 6.3.11.20 Observe that DSKY Row 1 displays 00004.
- 6.3.11.21 Release MARK X pushbutton
- 6.3.11.22 Observe that DSKY Row 1 displays 00000.
- 6.3.11.23 Press and hold the MARK Y pushbutton on the Computer Control and Reticule Dimmer Assembly.
- 6.3.11.24 Observe that DSKY Row 1 displays 00010.
- 6.3.11.25 Release MARK Y pushbutton.
- 6.3.11.26 Observe that DSKY Row 1 displays 00000.
- 6.3.11.27 Press and hold the REJECT pushbutton on the Computer Control and Reticule Dimmer Assembly.
- 6.3.11.28 Observe that DSKY Row 1 displays 00020.
- 6.3.11.29 Release the REJECT pushbutton.
- 6.3.11.30 Observe that DSKY Row 1 displays 00000.
- 6.3.11.31 On the DSKY perform the following operation:  
 VERB 36 ENTER
- 6.3.11.32 On the Computer Control and Reticule dimmer assembly, rotate the RETICLE BRIGHTNESS control to its minimum light intensity position. View through the AOT and verify that the reticle lamp is off.
- 6.3.11.33 While viewing through the AOT, slowly rotate the RETICLE BRIGHTNESS control to increase the reticle brightness until a stop is reached. Observe that the reticle brightness has increased in intensity. Return RETICLE BRIGHTNESS control to off state.

## 6.3.12 Gimbal Friction Test

## 6.3.12.1 Inner Gimbal Friction Test

## 6.3.12.1.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds  
 VERB 41 NOUN 20 ENTR  
 +00000 ENTR  
 +00000 ENTR  
 +00000 ENTR

6.3.12.1.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 ( $\pm 00200$ ).

## 6.3.12.1.3 Set up Analog Recorder to monitor the following signals:

| MEAS. NO.  | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2110 | IG Torque Motor Current |
| b. GG 2106 | IG Servo Error Total    |
| c. GG 2107 | IG Servo Error In Phase |
| d. GG 2112 | IG 1x Resolver Sine     |
| e. GG 2113 | IG 1x Resolver Cosine   |
| f. GG 2220 | IG CDU Fine Error       |
| g. GG 1201 | IMU 28V 14 800 CPS      |

## 6.3.12.1.4 Set up Analog Recorder to monitor the following signals:

| MEAS. NO.  | SIGNAL NAME         |
|------------|---------------------|
| a. GG 2300 | PIPA TEMP           |
| b. GG 2301 | IRIG TEMP           |
| c. GG 1520 | +28 VDC LDC OFR BUS |

## 6.3.12.1.5 After 10 seconds has elapsed since step 6.3.12.1.1, enter the following into K-148:

VERB 21 NOUN 01 ENTR  
 00403 ENTR  
 00000 ENTR

## 6.3.12.1.6 Verify on CRT, DSKY display

VERB 21 NOUN 01  
 R1 = 00000  
 R3 = 00403

## 6.3.12.1.7 On K-148 enter the following sequence:

NOUN 15 ENTR  
 00000 ENTR ENTR (Push ENTR pushbutton twice)  
 Verify R1 = +00000  
 37777 ENTR ENTR  
 Verify R1 = 37777  
 37743 ENTR ENTR  
 Verify R1 = 37743



6.3.12 Gimbal Friction Test

6.3.12.1 Inner Gimbal Friction Test

6.3.12.1.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR

6.3.12.1.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (+00200).

6.3.12.1.3 Set up Analog Recorder to monitor the following signals:

| MEAS. NO.  | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2110 | IG Torque Motor Current |
| b. GG 2106 | IG Servo Error Total    |
| c. GG 2107 | IG Servo Error In Phase |
| d. GG 2112 | IG 1x Resolver Sine     |
| e. GG 2113 | IG 1x Resolver Cosine   |
| f. GG 2220 | IG CDU Fine Error       |
| g. GG 1201 | IMU 28V 14 800 CPS      |

6.3.12.1.4 Set up Analog Recorder to monitor the following signals:

| MEAS. NO.  | SIGNAL NAME         |
|------------|---------------------|
| a. GG 2300 | PIPA TEMP           |
| b. GG 2301 | IRIG TEMP           |
| c. GG 1520 | +28 VDC LGC OPR BUS |

6.3.12.1.5 After 10 seconds has elapsed since step 6.3.12.1.1, enter the following into K-148:

VERB 21 NOUN 01 ENTR  
00403 ENTR  
00000 ENTR

6.3.12.1.6 Verify on CRT, DSKY display

VERB 21 NOUN 01  
R1 = 00000  
R3 = 00403

6.3.12.1.7 On K-148 enter the following sequence:

NOUN 15 ENTR  
00000 ENTR (Push ENTR pushbutton twice)  
Verify R1 = +00000  
37777 ENTR  
Verify R1 = 37777  
37743 ENTR  
Verify R1 = 37743

## 6.3.12.1.7 (cont)

00000 ENTER ENTER  
 Verify R1 = 00000  
 00000 ENTER (once)  
 Verify R1 = 00000

## 6.2.12.1.8 Start analog recorders using a chart speed of 10 mm/sec (IG-360° TORQUE)

## 6.3.12.1.9 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTER  
 00367 ENTER  
 Records contents of Row 1 XXXXY  
 VERB 21 NOUN 01 ENTER  
 00367 ENTER  
 XXXXY' ENTER  
 Where Y' is obtained from Table IIa.  
 VERB 42 ENTER  
 VERB 33 ENTER

## 6.3.12.1.10 Monitor analog recorder. When the IG Torque Motor Current signal (GG 2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

## 6.3.12.1.11 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTER Wait 3 seconds  
 VERB 41 NOUN 20 ENTER  
 +00000 ENTER  
 +00000 ENTER  
 +00000 ENTER

## 6.3.12.1.12 On the CRT, verify CDU X, CDU Y, CDU Z all indicate +00000 (+00200).

## 6.3.12.1.13 After 10 seconds has elapsed since step 6.3.12.1.11 enter the following sequence into K-148:

VERB 21 NOUN 01 ENTER  
 00403 ENTER  
 00000 ENTER

## 6.3.12.1.14 Verify on CRT, DSKY display

VERB 21 NOUN 01  
 R1 00000  
 R3 00403

## 6.3.12.1.15 On K-148 enter the following sequence:

NOUN 15 ENTER  
 00000 ENTER ENTER (Press ENTER pushbutton twice)  
 Verify R1 = 00000  
 40000 ENTER ENTER  
 Verify R1 = 40000

## 6.3.12.1.7 (cont)

00000 ENTER ENTER  
 Verify R1 = 00000  
 00000 ENTER (once)  
 Verify R1 = 00000

## 6.3.12.1.8 Start analog recorders using a chart speed of 10 mm/sec (IG-360° TORQUE)

## 6.3.12.1.9 On K-148 enter the following sequence:

VERB 01 NOUN 01 ENTER  
 00367 ENTER  
 Records contents of Row 1 XXXXY  
 VERB 21 NOUN 01 ENTER  
 00367 ENTER  
 XXXXY' ENTER  
 Where Y' is obtained from Table IIa.  
 VERB 42 ENTER  
 VERB 33 ENTER

## 6.3.12.1.10 Monitor analog recorder. When the IG Torque Motor Current signal (OG 2110) drops to a quiescent level (approximately 12 minutes), stop the recorders.

## 6.3.12.1.11 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTER Wait 3 seconds  
 VERB 41 NOUN 20 ENTER  
 +00000 ENTER  
 +00000 ENTER  
 +00000 ENTER

## 6.3.12.1.12 On the CRT, verify CDU X, CDU Y, CDU Z all indicate +00000 (+00200).

## 6.3.12.1.13 After 10 seconds has elapsed since step 6.3.12.1.11 enter the following sequence into K-148:

VERB 21 NOUN 01 ENTER  
 00403 ENTER  
 00000 ENTER

## 6.3.12.1.14 Verify on CRT, DSKY display

VERB 21 NOUN 01  
 R1 00000  
 R3 00403

## 6.3.12.1.15 On K-148 enter the following sequence:

NOUN 15 ENTER  
 00000 ENTER ENTER (Press ENTER pushbutton twice)  
 Verify R1 = 00000  
 40000 ENTER ENTER  
 Verify R1 = 40000

## 6.3.12.1.15 (cont)

40034 ENTER ENTER  
 Verify R1 = 40034  
 00000 ENTER ENTER  
 Verify R1 = 00000  
 00000 ENTER (once)  
 Verify R1 = 00000

6.3.12.1.16 Start analog recorders using a chart speed of 10 mm/sec  
(IG +360° TORQUE)

## 6.3.12.1.17 On K-148 enter the following sequence

VERB 42 ENTER  
 VERB 33 ENTER

6.3.12.1.18 Monitor analog recorder. When the IG Torque Motor Current signal  
(GG 2110) drops to a quiescent level (approximately 12 minutes), stop  
the recorders.

## 6.3.12.2 Outer Gimbal Friction Test

## 6.3.12.2.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTER Wait 3 seconds  
 VERB 41 NOUN 20 ENTER  
 +00000 ENTER  
 +00000 ENTER  
 +00000 ENTER

## 6.3.12.2.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

## 6.3.12.2.3 Set up analog recorder to monitor the following:

| MEAS NO.   | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2167 | OG Servo Error In Phase |
| b. GG 2170 | OG Torque Motor Current |
| c. GG 2166 | OG Servo Error Total    |
| d. GG 2280 | OG CDU Fine Error       |
| e. GG 2172 | OG LX Resolver Sine     |
| f. GG 2173 | OG LX Resolver Cosine   |

6.3.12.2.4 After 10 seconds has elapsed since step 6.3.12.2.1 enter the following  
sequence into K-148:

VERB 21 NOUN 01 ENTER  
 00403 ENTER  
 37777 ENTER

## 6.3.12.1.15 (cont)

40034 ENTER ENTER  
 Verify R1 = 40034  
 00000 ENTER ENTER  
 Verify R1 = 00000  
 00000 ENTER (once)  
 Verify R1 = 00000

6.3.12.1.16 Start analog recorders using a chart speed of 10 mm/sec  
(IG +360° TORQUE)

## 6.3.12.1.17 On K-148 enter the following sequence

VERB 42 ENTER  
 VERB 33 ENTER

6.3.12.1.18 Monitor analog recorder. When the IG Torque Motor Current signal  
(GG 2110) drops to a quiescent level (approximately 12 minutes), stop  
the recorders.

## 6.3.12.2 Outer Gimbal Friction Test

## 6.3.12.2.1 On K-148 enter the following sequence:

VERB 40 MOUN 20 ENTER Wait 3 seconds  
 VERB 41 MOUN 20 ENTER  
 +00000 ENTER  
 +00000 ENTER  
 +00000 ENTER

## 6.3.12.2.2 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (+00200).

## 6.3.12.2.3 Set up analog recorder to monitor the following:

| MEAS NO.   | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2167 | OG Servo Error In Phase |
| b. GG 2170 | OG Torque Motor Current |
| c. GG 2166 | OG Servo Error Total    |
| d. GG 2280 | OG CDU Fine Error       |
| e. GG 2172 | OG LX Resolver Sine     |
| f. GG 2173 | OG LX Resolver Cosine   |

6.3.12.2.4 After 10 seconds has elapsed since step 6.3.12.2.1 enter the following  
sequence into K-148:

VERB 21 MOUN 01 ENTER  
 00403 ENTER  
 37777 ENTER

6.3.12.2.5 Verify on CRT, DSKY display

VERB 21 NOUN 01  
R1 37777  
R3 00403

6.3.12.2.6 On K-148 enter the following sequence:

NOUN 15 ENTER  
37743 ENTER ENTER (Press ENTER pushbutton twice)  
Verify R1 = 37743  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER (once)  
Verify R1 = 00000

6.3.12.2.7 Start analog recorders using a chart speed of 10 mm/sec. (OG - 360° TORQUE)

6.3.12.2.8 On K-148 enter the following sequence:

VERB 42 ENTER  
VERB 33 ENTER

6.3.12.2.9 Monitor analog recorder. When the OG Torque Motor Current signal (OG 2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.2.10 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTER Wait 3 seconds  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER

6.3.12.2.11 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (+00000).

6.3.12.2.12 After 10 seconds has elapsed since step 6.3.12.2.10, enter the following sequence into K-148.

VERB 21 NOUN 01 ENTER  
00403 ENTER  
40000 ENTER

6.3.12.2.13 Verify on CRT, DSKY display.

VERB 21 NOUN 01  
R1 40000  
R3 00403

6.3.12.2.5 Verify on CRT, DSKY display

VERB 21 NOUN 01  
R1 37777  
R3 00403

6.3.12.2.6 On K-148 enter the following sequence:

NOUN 15 ENTR  
37743 ENTR ENTR (Press ENTR pushbutton twice)  
Verify R1 = 37743  
00000 ENTR ENTR  
Verify R1 = 00000  
00000 ENTR ENTR  
Verify R1 = 00000  
00000 ENTR ENTR  
Verify R1 = 00000  
00000 ENTR (once)  
Verify R1 = 00000

6.3.12.2.7 Start analog recorders using a chart speed of 10 mm/sec. (OG - 360° TORQUE)

6.3.12.2.8 On K-148 enter the following sequence:

VERB 42 ENTR  
VERB 33 ENTR

6.3.12.2.9 Monitor analog recorder. When the OG Torque Motor Current signal (OG 2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.2.10 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTR Wait 3 seconds  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
+00000 ENTR

6.3.12.2.11 On the CRT, verify CDU X, CDU Y, CDU Z indicate +00000 (±00200).

6.3.12.2.12 After 10 seconds has elapsed since step 6.3.12.2.10, enter the following sequence into K-148.

VERB 21 NOUN 01 ENTR  
00403 ENTR  
40000 ENTR

6.3.12.2.13 Verify on CRT, DSKY display.

VERB 21 NOUN 01  
R1 40000  
R3 00403

6.3.12.2.14 On K-148 enter the following sequence:

NOUN 15 ENTER  
40034 ENTER ENTER  
Verify R1 = 40034  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000 (once)  
Verify R1 = 00000

6.3.12.2.15 Start analog recorders using a chart speed of 10 mm/sec (OG +360° TORQUE)

6.3.12.2.16 On K-148 enter the following sequence

VERB 42 ENTER  
VERB 33 ENTER

6.3.12.2.17 Monitor analog recorder. When the OG Torque Motor Current signal (OG 2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.3 Middle Gimbal Friction Test

6.3.12.3.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTER Wait 3 seconds  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+06750 ENTER

6.3.12.3.2 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = +06750±00200.

6.3.12.3.3 Set up analog recorder to monitor the following:

| MEAS. NO.  | SIGNAL NAME             |
|------------|-------------------------|
| a. OG 2136 | MD Servo Error Total    |
| b. OG 2137 | MD Servo Error In Phase |
| c. OG 2150 | MD Torque Motor Current |
| d. OG 2143 | MD LX Resolver Cosine   |
| e. OG 2250 | MD CDU Fine Error       |
| f. OG 2142 | MD LX Resolver Sine     |

6.3.12.3.4 After 10 seconds have elapsed since step 6.3.12.3.1, enter the following sequence into K-148:

VERB 21 NOUN 01 ENTER  
00403 ENTER  
00000 ENTER



6.3.12.2.14 On K-148 enter the following sequence:

MOUW 15 ENTER  
40034 ENTER ENTER  
Verify R1 = 40034  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER (once)  
Verify R1 = 00000

6.3.12.2.15 Start analog recorders using a chart speed of 10 mm/sec (OG +360° TORQUE)

6.3.12.2.16 On K-148 enter the following sequence

VERB 42 ENTER  
VERB 33 ENTER

6.3.12.2.17 Monitor analog recorder. When the OG Torque Motor Current signal (OG 2170) drops to a quiescent level (approximately 12 minutes) stop the recorders.

6.3.12.3 Middle Gimbal Friction Test

6.3.12.3.1 On K-148 enter the following sequence:

VERB 40 MOUW 20 ENTER Wait 3 seconds  
VERB 41 MOUW 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+06750 ENTER

6.3.12.3.2 On the CRT, verify CDU X = +00000±00200, CDU Y = +00000±00200, and CDU Z = +06750±00200.

6.3.12.3.3 Set up analog recorder to monitor the following:

| MEAS. NO.  | SIGNAL NAME             |
|------------|-------------------------|
| a. OG 2136 | MG Servo Error Total    |
| b. OG 2137 | MG Servo Error In Phase |
| c. OG 2150 | MG Torque Motor Current |
| d. OG 2143 | MG 1X Resolver Cosine   |
| e. OG 2250 | MG CDU Fine Error       |
| f. OG 2142 | MG 1X Resolver Sine     |

6.3.12.3.4 After 10 seconds have elapsed since step 6.3.12.3.1, enter the following sequence into K-148:

VERB 21 MOUW 01 ENTER  
00403 ENTER  
00000 ENTER

6.3.12.3.5 Verify on CRT, DEKY display

VERB 21 NOUN 01  
R1 = 00000  
R3 = 00403

6.3.12.3.6 On K-148 enter the following sequence:

NOUN 15 ENTER  
00000 ENTER ENTER (Press ENTER pushbutton twice)  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
14000 ENTER ENTER  
Verify R1 = 14000  
00000 ENTER (Once)  
Verify R1 = 00000

6.3.12.3.7 Start analog recorders using a chart speed of 10 mm/sec. (MG - 135° TORQUE)

6.3.12.3.8 On K-148 enter the following sequence:

VERB 42 ENTER  
VERB 33 ENTER

6.3.12.3.9 Monitor analog recorder. When MG Torque Motor Current (OG 2140) drops to a quiescent level (approximately 6 minutes), stop the recorders.

6.3.12.3.10 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTER Wait 3 seconds  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
-06750 ENTER

6.3.12.3.11 On the CRT, verify CDU X = +00000±00200, and CDU Z = -06750±00200.

6.3.12.3.12 After 10 seconds has elapsed since step 6.3.12.3.10, enter the following sequence into K-148:

VERB 21 NOUN 01 ENTER  
00403 ENTER  
00000 ENTER

6.3.12.3.13 On the CRT, DEKY display verify:

VERB 21 NOUN 01  
R1 = 00000  
R3 = 00403

- 6.3.12.3.5 Verify on CRT, DSKY display
- VERB 21 NOUN 01  
R1 = 00000  
R3 = 00403
- 6.3.12.3.6 On K-148 enter the following sequence:
- NOUN 15 ENTR  
00000 ENTR ENTR (Press ENTR pushbutton twice)  
Verify R1 = 00000  
00000 ENTR ENTR  
Verify R1 = 00000  
00000 ENTR ENTR  
Verify R1 = 00000  
14000 ENTR ENTR  
Verify R1 = 14000  
00000 ENTR (Once)  
Verify R1 = 00000
- 6.3.12.3.7 Start analog recorders using a chart speed of 10 mm/sec. (MG - 135° TORQUE)
- 6.3.12.3.8 On K-148 enter the following sequence:
- VERB 42 ENTR  
VERB 33 ENTR
- 6.3.12.3.9 Monitor analog recorder. When MG Torque Motor Current (OG 2140) drops to a quiescent level (approximately 6 minutes), stop the recorders.
- 6.3.12.3.10 On K-148 enter the following sequence:
- VERB 40 NOUN 20 ENTR Wait 3 seconds  
VERB 41 NOUN 20 ENTR  
+00000 ENTR  
+00000 ENTR  
-06750 ENTR
- 6.3.12.3.11 On the CRT, verify CDU X = +00000+00200, and CDU Z = -06750+00200.
- 6.3.12.3.12 After 10 seconds has elapsed since step 6.3.12.3.10, enter the following sequence into K-148:
- VERB 21 NOUN 01 ENTR  
00403 ENTR  
00000 ENTR
- 6.3.12.3.13 On the CRT, DSKY display verify:
- VERB 21 NOUN 01  
R1 = 00000  
R3 = 00403

6.3.12.3.14 On K-148 enter the following sequence:

NOUN 15 ENTER  
00000 ENTER ENTER (Press ENTER pushbutton twice)  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
63777 ENTER ENTER  
Verify R1 = 63777 (once)  
77777 ENTER  
Verify R1 = 77777

6.3.12.3.15 Start analog recorders using a chart speed of 10 mm/sec. (MG +135° TORQUE)

6.3.12.3.16 On K-148 enter the following sequence:

VERB 42 ENTER  
VERB 33 ENTER

6.3.12.3.17 Monitor analog recorder. When the MG Torque Motor Current signal (GG 2140) drops to a quiescent level (approximately 6 minutes) stop the recorders.

6.3.12.3.18 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER  
Wait 15 seconds  
VERB 36 ENTER

6.3.12.4 Test Analysis

6.3.12.4.1 Remove the strip charts from analog recorders.

6.3.12.4.2 Examine each trace carefully to detect any sharp discontinuities of the traces. Disregard all transients less than 0.5 second (5 mm) on any Torque Motor Current signal. Disregard all transients less than 0.2 second (2 mm) on any CDU Fine Error signal.

6.3.12.4.3 No Torque Motor Current signal on (GG 2140, GG 2170, GG 2110) shall ever exceed (0.125) amp. Sensitivity on recorder is 20 mm/division.

6.3.12.4.4 No CDU Fine Error on (GG 2220, GG 2280, GG 2250) shall ever exceed (.070) volts. Sensitivity on recorder is 50 mv/division.

6.3.12.3.14 On K-148 enter the following sequence:

NOUN 15 ENTER  
00000 ENTER ENTER (Press ENTER pushbutton twice)  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
00000 ENTER ENTER  
Verify R1 = 00000  
63777 ENTER ENTER  
Verify R1 = 63777  
77777 ENTER (once)  
Verify R1 = 77777

6.3.12.3.15 Start analog recorders using a chart speed of 10 mm/sec. (MG +13° TORQUE)

6.3.12.3.16 On K-148 enter the following sequence:

VERB 42 ENTER  
VERB 33 ENTER

6.3.12.3.17 Monitor analog recorder. When the MG Torque Motor Current signal (GG 2140) drops to a quiescent level (approximately 6 minutes) stop the recorders.

6.3.12.3.18 On K-148 enter the following sequence:

VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER  
Wait 15 seconds  
VERB 36 ENTER

6.3.12.4 Test Analysis

6.3.12.4.1 Remove the strip charts from analog recorders.

6.3.12.4.2 Examine each trace carefully to detect any sharp discontinuities of the traces. Disregard all transients less than 0.5 second (5 mm) on any Torque Motor Current signal. Disregard all transients less than 0.2 second (2 mm) on any CDU Fine Error signal.

6.3.12.4.3 No Torque Motor Current signal on (GG 2140, GG 2170, GG 2110) shall ever exceed (0.125) amp. Sensitivity on recorder is 20 mA/division.

6.3.12.4.4 No CDU Fine Error on (GG 2220, GG 2280, GG 2250) shall ever exceed (.070) volts. Sensitivity on recorder is 50 mV/division.

6.3.13 Stabilization Loop Step Response Test

6.3.13.1 IG Response Test

6.3.13.1.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTER Wait 3 seconds  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER

6.3.13.1.2 On CRT, verify IG MD, and GG gimbal angles are between 358 and 002.

6.3.13.1.3 Set up analog recorder to monitor the following:

| MEAS. NO.  | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2110 | IG Torque Motor Current |
| b. GG 2106 | IG Servo Error Total    |
| c. GG 2107 | IG Servo Error In Phase |
| d. GG 2112 | IG 1X Resolver Sine     |
| e. GG 2113 | IG 1X Resolver Cosine   |
| f. GG 2220 | IG CDU Fine Error       |
| g. GG 1201 | IMU 28V 1 FCT 800 CPS   |

6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:

VERB 42 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER

6.3.13.1.5 On the CRT verify CDU X, CDU Y and CDU Z indicate +00000±00200.

**CAUTION:** If the transients caused by the subsequent step input do not damp out within 15 seconds, remove IMU Operate Power.

6.3.13.1.6 Enter 1000 into R-START 155.

6.3.13.1.7 Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the IG stabilization loop.

6.3.13.1.8 Prepare to start analog recorder at a chart speed of 100 mm/sec. (IG RESPONSE TEST).

6.3.13.1.9 Enter 0000 into R-START 155. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the IG stabilization loop.

6.3.13.1.10 After the transient on the recorder has died out, stop the recorder.

6.3.13 Stabilization Loop Step Response Test

6.3.13.1 IG Response Test

6.3.13.1.1 On K-148 enter the following sequence:

VERB 40 NOUN 20 ENTER Wait 3 seconds  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER

6.3.13.1.2 On CRT, verify IG MU, and GG gimbal angles are between 358 and 002.

6.3.13.1.3 Set up analog recorder to monitor the following:

| MEAS. NO.  | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2110 | IG Torque Motor Current |
| b. GG 2106 | IG Servo Error Total    |
| c. GG 2107 | IG Servo Error In Phase |
| d. GG 2112 | IG 1X Resolver Sine     |
| e. GG 2113 | IG 1X Resolver Cosine   |
| f. GG 2220 | IG CDU Fine Error       |
| g. GG 1201 | IMU 28V 1 PCT 800 CPS   |

6.3.13.1.4 On K-148 initiate FINE ALIGN by entering the following sequence:

VERB 42 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER

6.3.13.1.5 On the CRT verify CDU X, CDU Y and CDU Z indicate +00000±00200.

**CAUTION:** If the transients caused by the subsequent step input do not damp out within 15 seconds, remove IMU Operate Power.

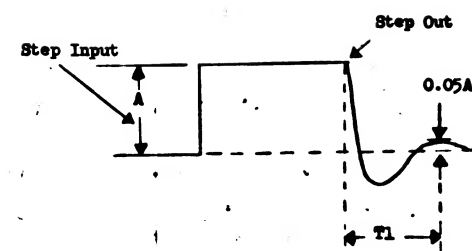
6.3.13.1.6 Enter 1000 into R-START 155.

6.3.13.1.7 Press XEQ/SEAL pushbutton on R-155 to enter the DC step voltage into the IG stabilization loop.

6.3.13.1.8 Prepare to start analog recorder at a chart speed of 100 mm/sec. (IG RESPONSE TEST).

6.3.13.1.9 Enter 0000 into R-START 155. Start analog recorder. Press the XEQ/SEAL pushbutton to remove the step input to the IG stabilization loop.

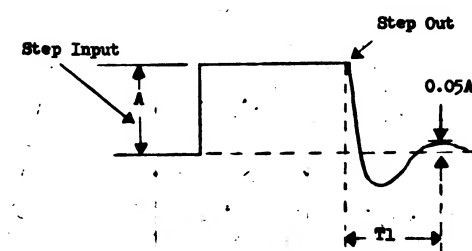
6.3.13.1.10 After the transient on the recorder has died out, stop the recorder.



TYPICAL STAB. LOOP RESPONSE TO STEP INPUT

FIGURE 3





TYPICAL STAB. LOOP RESPONSE TO STEP INPUT

FIGURE 3

- 6.3.13.1.11 From the Servo Error In Phase signal recorder trace measure the time interval (T<sub>1</sub>, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period T<sub>1</sub> shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.
- 6.3.13.2 MG Response Test
- 6.3.13.2.1 Set up analog recorder to monitor the following:
- | MEAS NO.   | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2136 | MG Servo Error Total    |
| b. GG 2137 | MG Servo Error In Phase |
| c. GG 2140 | MG Torque Motor Current |
| d. GG 2143 | MG LX Resolver Cosine   |
| e. GG 2250 | MG CDU Fine Error       |
| f. GG 2142 | MG LX Resolver Sine     |
| g. GG 1201 | IMU 28V 14 800 cps      |
- 6.3.13.2.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).
- CAUTION:** If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate Power.
- 6.3.13.2.3 Enter 0100 into R-START 155. Press XEQ/SEAL pushbutton R-155 to enter the DC step voltage into the MG stabilization loop.
- 6.3.13.2.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (MG RESPONSE TEST).
- 6.3.13.2.5 Enter 0000 into R-START 155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.
- 6.3.13.2.6 After the transient on the recorder has died out, stop the recorder.
- 6.3.13.2.7 From the Servo Error In Phase signal recorder trace measure the time interval (T<sub>1</sub>, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period, T<sub>1</sub>, shall not exceed 0.1 seconds and the trace shall have no more than 3 overshoots.

- 6.3.13.1.11 From the Servo Error In Phase signal recorder trace measure the time interval (T<sub>1</sub>, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period T<sub>1</sub> shall not exceed 0.1 second and the trace shall have no more than 3 overshoots.
- 6.3.13.2 MG Response Test
- 6.3.13.2.1 Set up analog recorder to monitor the following:
- | MEAS NO.   | SIGNAL NAME             |
|------------|-------------------------|
| a. GG 2136 | MG Servo Error Total    |
| b. GG 2137 | MG Servo Error In Phase |
| c. GG 2140 | MG Torque Motor Current |
| d. GG 2143 | MG LX Resolver Cosine   |
| e. GG 2250 | MG CDU Fine Error       |
| f. GG 2142 | MG LX Resolver Sine     |
| g. GG 1201 | IMU 28V 14 800 cps      |
- 6.3.13.2.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000 (±00200).
- CAUTION:** If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU Operate Power.
- 6.3.13.2.3 Enter 0100 into R-START 155. Press XEQ/SEAL pushbutton R-155 to enter the DC step voltage into the MG stabilization loop.
- 6.3.13.2.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (MG RESPONSE TEST).
- 6.3.13.2.5 Enter 0000 into R-START 155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the MG stabilization loop.
- 6.3.13.2.6 After the transient on the recorder has died out, stop the recorder.
- 6.3.13.2.7 From the Servo Error In Phase signal recorder trace measure the time interval (T<sub>1</sub>, Fig. 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period, T<sub>1</sub>, shall not exceed 0.1 seconds and the trace shall have no more than 3 overshoots.

6.3.13.3 OG Response Test

6.3.13.3.1 Set up analog recorder to monitor the following:

| MEAS NO.   | SIGNAL NAME             |
|------------|-------------------------|
| a. OG 2167 | OG Servo Error In Phase |
| b. OG 2170 | OG Torque Motor Current |
| c. OG 2166 | OG Servo Error Total    |
| d. OG 2280 | OG CDU Fine Error       |
| e. OG 2172 | OG LX Resolver Sine     |
| f. OG 2173 | OG LX Resolver Cosine   |
| g. OG 1201 | IMU 28V 14 800 cps      |

6.3.13.3.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000(+00200).

**CAUTION:** If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU operate power.

6.3.13.3.3 Enter 0010 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the EC step voltage into the OG stabilisation loop.

6.3.13.3.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (OG RESPONSE TEST).

6.3.13.3.5 Enter 0000 into R-155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the OG stabilisation loop.

6.3.13.3.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.3.7 From the Servo Error In Phase signal recorder trace, measure the time interval (T<sub>1</sub>, Fig 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period, T<sub>1</sub>, shall not exceed 0.1 second and the trace shall have not more than 3 overshoots.

6.3.13.3.8 On K-148 enter the following sequence:

```

VERB 41 NOUN 20 ENTER
+00000 ENTER
+00000 ENTER
+00000 ENTER

```

6.3.13.3 OG Response Test

6.3.13.3.1 Set up analog recorder to monitor the following:

| MEAS NO.   | SIGNAL NAME             |
|------------|-------------------------|
| a. OG 2167 | OG Servo Error In Phase |
| b. OG 2170 | OG Torque Motor Current |
| c. OG 2166 | OG Servo Error Total    |
| d. OG 2280 | OG CDU Fine Error       |
| e. OG 2172 | OG LX Resolver Sine     |
| f. OG 2173 | OG LX Resolver Cosine   |
| g. OG 1201 | IMU 28V 14 800 cps      |

6.3.13.3.2 On the CRT, verify CDU X, CDU Y and CDU Z indicate +00000(±00200).

**CAUTION:** If the transients caused by the subsequent step input do not die out within 15 seconds, remove IMU operate power.

6.3.13.3.3 Enter 0010 into R-START 155. Press XEQ/SEAL pushbutton on R-155 to enter the BC step voltage into the OG stabilisation loop.

6.3.13.3.4 Prepare to start analog recorder at a chart speed of 100 mm/sec. (OG RESPONSE TEST).

6.3.13.3.5 Enter 0000 into R-155. Start analog recorder. Press XEQ/SEAL pushbutton to remove the step input to the OG stabilisation loop.

6.3.13.3.6 After the transient on the recorder has died out, stop the recorder.

6.3.13.3.7 From the Servo Error In Phase signal recorder trace, measure the time interval (T<sub>1</sub>, Fig 3) between the removal of the step input to the point at which the trace settles to within 5 percent of the step magnitude (A, Fig. 3). The period, T<sub>1</sub>, shall not exceed 0.1 second and the trace shall have not more than 3 overshoots.

6.3.13.3.8 On K-148 enter the following sequence:

```

VERB #1 NOUN 20 ENTER
+00000 ENTER
+00000 ENTER
+00000 ENTER

```

- 6.3.14 GAN Fine Alignment Test
- 6.3.14.1 On K-148 enter:
- VERB 01 NOUN 10 ENTER  
00003 ENTER
- 6.3.14.2 Record CRT, DSKY Row 1 display as AAAAA and the time of day.
- 6.3.14.3 On K-148 enter:
- VERB 21 NOUN 01 ENTER  
01777 ENTER  
AAAAA ENTER  
VERB 06 NOUN 02 ENTER  
01777 ENTER
- 6.3.14.4 Record CRT DSKY Row 1, display as ± BBBB.
- 6.3.14.5 Perform the following calculations:
- a.  $\frac{BBBBB \times 5.12}{3600} = CCCC.C$  Contents of high order scalar register in hours.
- b.  $23.3 - CCCC.C = DDDD.D$  Time left in high order scalar register until overflow.
- c. DDDD.D = time of day recorded in step 3 - time of day at which high order scalar register will overflow.
- 6.3.14.6 If the time of day is within 12 minutes of that time calculated in 6.3.14.5.c when about to complete step 6.3.14.30 wait until that time calculated in c has passed and then proceed.
- NOTE: Use of Dioptomster is required for all optical sightings using AOT.
- 6.3.14.7 On K-148 enter:
- VERB 01 NOUN 01 ENTER  
00367 ENTER  
Record contents of Row 1 XXXXY  
VERB 21 NOUN 01 ENTER  
00367 ENTER  
XXXXY' ENTER  
Where Y' is obtained from Table IIa.  
VERB 57 ENTER  
00003 ENTER

- 6.3.14 G&N Fine Alignment Test
- 6.3.14.1 On K-148 enter:
- VERB 01 MOUN 10 ENTER  
00003 ENTER
- 6.3.14.2 Record CRT, DSKY Row 1 display as AAAAA and the time of day.
- 6.3.14.3 On K-148 enter:
- VERB 21 MOUN 01 ENTER  
01777 ENTER  
AAAAA ENTER  
VERB 06 MOUN 02 ENTER  
01777 ENTER
- 6.3.14.4 Record CRT DSKY Row 1, display as ± BBBB.
- 6.3.14.5 Perform the following calculations:
- a.  $\frac{BBBBB \times 5.12}{3600} = CCCC.C$  Contents of high order scalar register in hours.
- b.  $23.3 - CCCC.C = DDDD.D$  Time left in high order scalar register until overflow.
- c.  $DDDD.D \div \text{time of day recorded in step 3} = \text{time of day at which high order scalar register will overflow.}$
- 6.3.14.6 If the time of day is within 12 minutes of that time calculated in 6.3.14.5.c when about to complete step 6.3.14.30 wait until that time calculated in c has passed and then proceed.
- NOTE: Use of Dioptrimeter is required for all optical sightings using AOT.
- 6.3.14.7 On K-148 enter:
- VERB 01 MOUN 01 ENTER  
00367 ENTER  
Record contents of Row 1 XXXXX  
VERB 21 MOUN 01 ENTER  
00367 ENTER  
XXXXX' ENTER  
Where Y' is obtained from Table IIA.  
VERB 57 ENTER  
00003 ENTER

6.3.14.8 Verify CRT DSKY display as:

VERB 06 MOUN 61 (Flashing)  
R1 = +13500 (SM Azimuth)  
R2 = 28.156 (Site Latitude)

NOTE: If R1 and R2 indications are correct proceed to step 6.3.14.10.

6.3.14.9 On K-148 enter:

VERB 21 ENTR  
+13500 ENTR  
VERB 22 ENTR  
+28.156 ENTR

6.3.14.10 On K-148 enter:

VERB 33 ENTR  
Observe on CRT DSKY display  
VERB 21 MOUN 30 (Flashing)

6.3.14.11 On K-148 enter:

0000X ENTR (Test position, either 1 or 2)  
00000 ENTR (Use AOT)  
Observe on CRT DSKY display:  
VERB 06 MOUN 61 (Flashing)  
Disregard Row 1, 2, and 3 indications.

6.3.14.12 On K-148 enter:

VERB 21 ENTR  
+XXX.XX ENTR (L tgt. true azimuth from 6.3.15.1.14)  
VERB 22 ENTR  
+XXX.XX ENTR (L tgt. elevation from 6.3.15.1.3)  
VERB 23 ENTR  
00001 ENTR (L tgt. number)  
VERB 33 ENTR

Observe on CRT DSKY display:  
VERB 06 MOUN 61 (Flashing)

Disregard Row 1, 2, and 3 indications.

6.3.14.13 On K-148 enter:

VERB 21 ENTR  
+XXX.XX ENTR (F tgt. true azimuth from 6.3.15.1.14)  
VERB 22 ENTR  
+XXX.XX ENTR (F tgt. elevation from 6.3.15.1.12)  
VERB 23 ENTR  
00002 ENTR (F tgt. number)  
VERB 33 ENTR

Observe on CRT DSKY display  
VERB 51 (flashing)  
R1 = 00001



6.3.14.8 Verify CRT DSKY display as:  
 VERB 06 NOUN 61 (Flashing)  
 R1 = +13500 (SM Azimuth)  
 R2 = 28.156 (Site Latitude)  
 NOTE: If R1 and R2 indications are correct proceed to step 6.3.14.10.

6.3.14.9 On K-148 enter:  
 VERB 21 ENTER  
 +13500 ENTER  
 VERB 22 ENTER  
 +28.156 ENTER

6.3.14.10 On K-148 enter:  
 VERB 33 ENTER  
 Observe on CRT DSKY display  
 VERB 21 NOUN 30 (Flashing)

6.3.14.11 On K-148 enter:  
 OOOOX ENTER (Test position, either 1 or 2)  
 OOOOO ENTER (Use AOT)  
 Observe on CRT DSKY display:  
 VERB 06 NOUN 61 (Flashing)  
 Disregard Row 1, 2, and 3 indications.

6.3.14.12 On K-148 enter:  
 VERB 21 ENTER  
 +XXX.XX ENTER (L tgt. true azimuth from 6.3.15.1.14)  
 VERB 22 ENTER  
 +XXX.XX ENTER (L tgt. elevation from 6.3.15.1.3)  
 VERB 23 ENTER  
 OOOO1 ENTER (L tgt. number)  
 VERB 33 ENTER  
 Observe on CRT DSKY display:  
 VERB 06 NOUN 61 (Flashing)  
 Disregard Row 1, 2, and 3 indications.

6.3.14.13 On K-148 enter:  
 VERB 21 ENTER  
 +XXX.XX ENTER (F tgt. true azimuth from 6.3.15.1.14)  
 VERB 22 ENTER  
 +XXX.XX ENTER (F tgt. elevation from 6.3.15.1.12)  
 VERB 23 ENTER  
 OOOO2 ENTER (F tgt. number)  
 VERB 33 ENTER  
 Observe on CRT DSKY display  
 VERB 51 (flashing)  
 R1 = OOOO1

- 6.3.14.14 On Computer Control and Reticle Dimmer Assembly, press MARK X push-button. Observe on DSKY display:  
VERB 21 NOUN 30 (Flashing)
- 6.3.14.15 On DSKY press ENTER.  
Observe on DSKY display:  
VERB 21 NOUN 43 (Flashing)
- 6.3.14.16 On DSKY enter:  
00001 ENTER (L Detent Code)  
Observe on DSKY display  
VERB 21 NOUN 42 (Flashing)
- 6.3.14.17 Set AOT to "L" position.
- 6.3.14.18 Rotate AOT control knob until the center of the L tgt. reticle is superimposed between the double Y reticle. Record AOT counter value as LY XXX.XX.
- 6.3.14.19 Rotate AOT control knob until the center of the L tgt. reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as LS XXX.XX.
- 6.3.14.20 On DSKY enter:  
±XXX.XX ENTER (value of LY)  
Observe on DSKY display:  
VERB 22 NOUN 42 (Flashing)
- 6.3.14.21 On DSKY enter:  
±XXX.XX ENTER (Value of LS)  
Observe on DSKY display:  
VERB 51 (Flashing)  
R1 = 00002
- 6.3.14.22 On Computer Control and Reticle Dimmer Assembly, press MARK X push-button. Observe on DSKY display:  
VERB 21 NOUN 30 (Flashing)
- 6.3.14.23 On DSKY press ENTER. Observe on DSKY display:  
VERB 21 NOUN 43 (Flashing)
- 6.3.14.24 On DSKY enter:  
00002 ENTER (F Detent Code)  
Observe on DSKY display:  
VERB 21 NOUN 42 (Flashing)

- 6.3.14.14 On Computer Control and Reticule Dimmer Assembly, press MARK X push-button. Observe on DSKY display:  
VERB 21 NOUN 30 (Flashing)
- 6.3.14.15 On DSKY press ENTER.  
Observe on DSKY display:  
VERB 21 NOUN 43 (Flashing)
- 6.3.14.16 On DSKY enter:  
00001 ENTER (L Detent Code)  
Observe on DSKY display  
VERB 21 NOUN 42 (Flashing)
- 6.3.14.17 Set AOT to "L" position.
- 6.3.14.18 Rotate AOT control knob until the center of the L tgt. reticle is superimposed between the double Y reticle. Record AOT counter value as LY XXX.XX.
- 6.3.14.19 Rotate AOT control knob until the center of the L tgt. reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as LS XXX.XX.
- 6.3.14.20 On DSKY enter:  
+XXX.XX ENTER (value of LY)  
Observe on DSKY display:  
VERB 22 NOUN 42 (Flashing)
- 6.3.14.21 On DSKY enter:  
+XXX.XX ENTER (Value of LS)  
Observe on DSKY display:  
VERB 51 (Flashing)  
R1 = 00002
- 6.3.14.22 On Computer Control and Reticule Dimmer Assembly, press MARK X push-button. Observe on DSKY display:  
VERB 21 NOUN 30 (Flashing)
- 6.3.14.23 On DSKY press ENTER. Observe on DSKY display:  
VERB 21 NOUN 43 (Flashing)
- 6.3.14.24 On DSKY enter:  
00002 ENTER (F Detent Code)  
Observe on DSKY display:  
VERB 21 NOUN 42 (Flashing)

- 6.3.14.25 Set AOT to "F" position.
- 6.3.14.26 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double Y reticle. Record AOT counter value as FY XXX.XX.
- 6.3.14.27 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as FS XXX.XX.
- 6.3.14.28 On DSKY enter:  
±XXX.XX ENTER (value of FY)  
Observe on DSKY display:  
VERB 22 NOUN 42 (Flashing)
- 6.3.14.29 On DSKY enter:  
±XXX.XX ENTER (value of FS)  
  
NOTE: Wait until DSKY display indicates VERB 51 (Flashing) R1 = 00001 before proceeding.  
  
NOTE: Before completing step 6.3.14.30 check time of day to verify that the high order scalar will not overflow within the next 12 minutes.
- 6.3.14.30 Repeat steps 6.3.14.14 through 6.3.14.29.
- 6.3.14.31 In approximately 7 minutes, observe on CRT DSKY display and record.  
VERB 06 NOUN 66 (Flashing)  
R1 = XXXXX (Whole number part of  $Y_{sm}$  misalignment about  $Z_{sm}$ )  
R2 = .XXXXX (Fractional number part of  $Y_{sm}$  misalignment about  $Z_{sm}$ .)
- 6.3.14.32 On K-148 enter.  
VERB 33 ENTER  
Observe on CRT DSKY display and record:  
VERB 06 NOUN 66 (Flashing)  
  
R1 = XXXXX (Whole number part of  $Z_{sm}$  misalignment about  $Y_{sm}$ )  
R2 = .XXXXX (Fractional number part of  $Z_{sm}$  misalignment about  $Y_{sm}$ )
- 6.3.14.33 On K-148 enter:  
VERB 36 ENTER  
Press ERROR RESET
- 6.3.14.34 Repeat steps 6.3.14.7 through 6.3.14.30.

- 6.3.14.25 Set AOT to "F" position.
- 6.3.14.26 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double Y reticle. Record AOT counter value as FY XXX.XX.
- 6.3.14.27 Rotate AOT control knob until the center of the F tgt. reticle is superimposed between the double lines of the SPIRAL reticle. Record AOT counter value as FS XXX.XX.
- 6.3.14.28 On DSKY enter:  
+XXX.XX ENTER (value of FY)  
Observe on DSKY display:  
VERB 22 NOUN 42 (Flashing)
- 6.3.14.29 On DSKY enter:  
+XXX.XX ENTER (value of FS)  
  
NOTE: Wait until DSKY display indicates VERB 51 (Flashing) R1 = 00001 before proceeding.  
  
NOTE: Before completing step 6.3.14.30 check time of day to verify that the high order scalar will not overflow within the next 12 minutes.
- 6.3.14.30 Repeat steps 6.3.14.14 through 6.3.14.29.
- 6.3.14.31 In approximately 7 minutes, observe on CRT DSKY display and record.  
VERB 06 NOUN 66 (Flashing)  
R1 = XXXXX (Whole number part of  $Y_{sm}$  misalignment about  $Z_{sm}$ )  
R2 = .XXXXX (Fractional number part of  $Y_{sm}$  misalignment about  $Z_{sm}$ )
- 6.3.14.32 On K-148 enter.  
VERB 33 ENTER  
Observe on CRT DSKY display and record:  
VERB 06 NOUN 66 (Flashing)  
  
R1 = XXXXX (Whole number part of  $Z_{sm}$  misalignment about  $Y_{sm}$ )  
R2 = .XXXXX (Fractional number part of  $Z_{sm}$  misalignment about  $Y_{sm}$ )
- 6.3.14.33 On K-148 enter:  
VERB 36 ENTER  
Press ERROR RESET
- 6.3.14.34 Repeat steps 6.3.14.7 through 6.3.14.30.

- 6.3.14.35 In approximately 7 minutes, observe on CRT DSKY display and record.
- VERB 06 NOUN 66 (Flashing)  
R1 = XXXXX (Whole number part of Xsm misalignment about Ysm)  
R2 = .XXXXX (Fractional number part of Xsm misalignment about Ysm)
- 6.3.14.36 On K-148 enter:
- VERB 33 ENTER  
Observe on CRT DSKY display and record:  
VERB 06 NOUN 66 (Flashing)  
R1 = XXXXX (Whole number part of Ysm misalignment about Xsm)  
R2 = .XXXXX (Fractional number part of Ysm misalignment about Xsm)
- 6.3.14.37 On K-148 enter:
- VERB 36 ENTER  
Press ERROR RESET  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER
- 6.3.14.38 Results. The PIPA bias determined previously in the DMU Performance Test (6.3.9) must be subtracted from the resultant data of the test.
- 6.3.14.38.1 Y PIPA misalignment
- |                                            |    |           |
|--------------------------------------------|----|-----------|
|                                            | R1 | R2        |
| About Z axis (from 6.3.14.31) = ±XXXXX.    |    | XXXXX sec |
| Less Y PIPA bias (from 6.3.9) = -(±XXXXX). |    | XXXXX sec |
| Y PIPA misalignment about Z axis = ±-----. |    | ----- sec |
| This value shall not exceed 255 sec        |    |           |
- 6.3.14.38.2 Z PIPA misalignment
- |                                            |    |           |
|--------------------------------------------|----|-----------|
|                                            | R1 | R2        |
| About Y axis (from 6.3.14.32) = ±XXXXX.    |    | XXXXX sec |
| Less Z PIPA bias (from 6.3.9) = -(±XXXXX). |    | XXXXX sec |
| Z PIPA misalignment about Y axis = ±-----. |    | ----- sec |
| This value shall not exceed 255 sec        |    |           |
- 6.3.14.38.3 X PIPA misalignment
- |                                            |    |           |
|--------------------------------------------|----|-----------|
|                                            | R1 | R2        |
| About Y axis (from 6.3.14.35) = ±XXXXX.    |    | XXXXX sec |
| Less X PIPA bias from (6.3.9) = -(±XXXXX). |    | XXXXX sec |
| X PIPA misalignment about Y axis = ±-----. |    | ----- sec |
| This value shall not exceed 255 sec        |    |           |
- 6.3.14.38.4 Y PIPA misalignment
- |                                            |    |           |
|--------------------------------------------|----|-----------|
|                                            | R1 | R2        |
| About X axis from (6.3.14.36) = ±XXXXX.    |    | XXXXX sec |
| Less Y PIPA bias (from 6.3.9) = -(±XXXXX). |    | XXXXX sec |
| Y PIPA misalignment about X axis = ±-----. |    | ----- sec |
| This value shall not exceed 255 sec        |    |           |

6.3.14.35 In approximately 7 minutes, observe on CRT DSKY display and record.

VERB 06 NOUN 66 (Flashing)  
R1 = XXXXX (Whole number part of Xsm misalignment about Ysm)  
R2 = .XXXXX (Fractional number part of Xsm misalignment about Ysm)

6.3.14.36 On K-148 enter:

VERB 33 ENTER  
Observe on CRT DSKY display and record:  
VERB 06 NOUN 66 (Flashing)  
R1 = XXXXX (Whole number part of Ysm misalignment about Xsm)  
R2 = .XXXXX (Fractional number part of Ysm misalignment about Xsm)

6.3.14.37 On K-148 enter:

VERB 36 ENTER  
Press ERROR RESET  
VERB 41 NOUN 20 ENTER  
+00000 ENTER  
+00000 ENTER  
+00000 ENTER

6.3.14.38 Results. The PIPA bias determined previously in the IMU Performance Test (6.3.9) must be subtracted from the resultant data of the test.

6.3.14.38.1 Y PIPA misalignment

|                                            |           |    |
|--------------------------------------------|-----------|----|
|                                            | R1        | R2 |
| About Z axis (from 6.3.14.31) = ±XXXXX.    | XXXXX sec |    |
| Less Y PIPA bias (from 6.3.9) = -(±XXXXX). | XXXXX sec |    |
| Y PIPA misalignment about Z axis = ±-----. | ----- sec |    |
| This value shall not exceed 255 sec        |           |    |

6.3.14.38.2

|                                            |           |    |
|--------------------------------------------|-----------|----|
|                                            | R1        | R2 |
| About Y axis (from 6.3.14.32) = ±XXXXX.    | XXXXX sec |    |
| Less Z PIPA bias (from 6.3.9) = -(±XXXXX). | XXXXX sec |    |
| Z PIPA misalignment about Y axis = ±-----. | ----- sec |    |
| This value shall not exceed 255 sec        |           |    |

6.3.14.38.3 Z PIPA misalignment

|                                            |           |    |
|--------------------------------------------|-----------|----|
|                                            | R1        | R2 |
| About Y axis (from 6.3.14.35) = ±XXXXX.    | XXXXX sec |    |
| Less X PIPA bias from (6.3.9) = -(±XXXXX). | XXXXX sec |    |
| X PIPA misalignment about Y axis = ±-----. | ----- sec |    |
| This value shall not exceed 255 sec        |           |    |

6.3.14.38.4 Y PIPA misalignment

|                                            |           |    |
|--------------------------------------------|-----------|----|
|                                            | R1        | R2 |
| About X axis from (6.3.14.36) = ±XXXXX.    | XXXXX sec |    |
| Less Y PIPA bias (from 6.3.9) = -(±XXXXX). | XXXXX sec |    |
| Y PIPA misalignment about X axis = ±-----. | ----- sec |    |
| This value shall not exceed 255 sec        |           |    |

6.3.15 AOT Functional Accuracy Test

NOTE: Use of a Dioptrimeter is required when sighting through AOT.

6.3.15.1 Determination of Detent Angle Reference.

NOTE: The included angles between targets LOS shall be known to  $\pm 10$  arc seconds. The elevation of each target LOS shall be known to  $\pm 15$  arc seconds.

6.3.15.1.1 Place AOT in L detent position.

NOTE: Communication between AOT and target theodolite operators is required.

6.3.15.1.2 While viewing through AOT, instruct the target L operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target L, until the target reticle appears in the lower right quadrant of the AOT field of view.

NOTE: The target theodolite base must be level when alignment is achieved.

6.3.15.1.3 Upon alignment, zero the azimuth dial and record the elevation indication of target L as  $\beta_1$ .

6.3.15.1.4 Place AOT in R detent position.

6.3.15.1.5 While viewing through AOT, instruct the target R operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target R, until the target reticle appears in the lower left quadrant of the AOT field of view.

6.3.15.1.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record the target R elevation dial indication, as  $\beta_2$ . Zero the target R azimuth dial. Record AOT dial indication as  $\alpha_1 = XXX.XX$ .

6.3.15.1.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT dial indication as  $\alpha_2 = XXX.XX$ .

6.3.15.1.8 Collimate L and R targets on each other, record each target azimuth with each target LOS leveled.

Target L as  $\alpha_1$ , Target R as  $\alpha_2$

6.3.15.1.9 Place the AOT in F detent position.



6.3.15 AOT Functional Accuracy Test

NOTE: Use of a Dioptrimeter is required when sighting through AOT.

6.3.15.1 Determination of Detent Angle Reference.

NOTE: The included angles between targets LOS shall be known to  $\pm 10$  arc seconds. The elevation of each target LOS shall be known to  $\pm 15$  arc seconds.

6.3.15.1.1 Place AOT in L detent position.

NOTE: Communication between AOT and target theodolite operators is required.

6.3.15.1.2 While viewing through AOT, instruct the target L operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target L, until the target reticle appears in the lower right quadrant of the AOT field of view.

NOTE: The target theodolite base must be level when alignment is achieved.

6.3.15.1.3 Upon alignment, zero the azimuth dial and record the elevation indication of target L as  $\theta_1$ .

6.3.15.1.4 Place AOT in R detent position.

6.3.15.1.5 While viewing through AOT, instruct the target R operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target R, until the target reticle appears in the lower left quadrant of the AOT field of view.

6.3.15.1.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record the target R elevation dial indication, as  $\theta_2$ . Zero the target R azimuth dial. Record AOT dial indication as  $\theta_3$ .  $\theta_3 = XXX.XX$ .

6.3.15.1.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT dial indication as  $\theta_4$ .  $\theta_4 = XXX.XX$ .

6.3.15.1.8 Collimate L and R targets on each other, record each target azimuth with each target LOS leveled.

Target L as  $\alpha_1$ , Target R as  $\alpha_2$

6.3.15.1.9 Place the AOT in F detent position.

- 6.3.15.1.10 Move the R target theodolite to a position in front of the AOT F detent position. (The target shall now be referred to as the F target).
- 6.3.15.1.11 While viewing through the AOT, instruct the target F operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target reticle appears in the center of the AOT reticle.
- 6.3.15.1.12 Upon alignment, zero the azimuth dial and record the elevation indication of target F as  $\beta_2$ .
- 6.3.15.1.13 Collimate L and F targets on each other, record each target azimuth with each target LOS leveled. Target F as  $\alpha_2$ .
- 6.3.15.1.14 Determine the true azimuth of targets L and F with respect to the AOT. The target azimuth shall be known to within 0.5 arc degrees.
- 6.3.15.1.15 Rotate the F target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.12.
- 6.3.15.1.16 Rotate the L target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.13.
- 6.3.15.1.17 Calculate the values of the included angles between target L and F as  $X_1$  and targets L and R as  $X_2$ .
- $$X_1 = \cos^{-1} \{ \sin \beta_1 \sin \beta_2 + \cos \beta_1 \cos \beta_2 \cos [180 - (\alpha_1 + \alpha_2)] \}$$
- $$X_2 = \cos^{-1} \{ \sin \beta_1 \sin \beta_3 + \cos \beta_1 \cos \beta_3 \cos [180 - (\alpha_3 + \alpha_1)] \}$$
- Where:  $\alpha_1$  = as value, step 6.3.15.1.8  
 $\alpha_2$  = as value, step 6.3.15.1.13  
 $\alpha_3$  = as value, step 6.3.15.1.8

#### 6.3.15.2 Computer Loading of Detent Calibration Data

##### 6.3.15.2.1 On K-148 enter:

|         |         |                          |
|---------|---------|--------------------------|
| VERB 21 | NOUN 03 | ENTER                    |
| 01467   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent L AG data) |
|         |         | ENTER                    |
| 01470   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent F AG data) |
|         |         | ENTER                    |
| 01471   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent R AG data) |
|         |         | ENTER                    |
| 01472   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent L EL data) |
|         |         | ENTER                    |
| 01473   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent F EL data) |
|         |         | ENTER                    |

- 6.3.15.1.10 Move the R target theodolite to a position in front of the AOT F detent position. (The target shall now be referred to as the F target).
- 6.3.15.1.11 While viewing through the AOT, instruct the target F operator to translate (vertically and laterally) and rotate (in azimuth and elevation) target reticle appears in the center of the AOT reticle.
- 6.3.15.1.12 Upon alignment, zero the azimuth dial and record the elevation indication of target F as  $\beta_2$ .
- 6.3.15.1.13 Collimate L and F targets on each other, record each target azimuth with each target LOS leveled. Target F as  $\alpha_2$ .
- 6.3.15.1.14 Determine the true azimuth of targets L and F with respect to the AOT. The target azimuth shall be known to within 0.5 arc degrees.
- 6.3.15.1.15 Rotate the F target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.12.
- 6.3.15.1.16 Rotate the L target in azimuth and elevation to the specified and recorded angles of 6.3.15.1.13.
- 6.3.15.1.17 Calculate the values of the included angles between target L and F as  $X_1$  and targets L and R as  $X_2$ .

$$X_1 = \cos^{-1} \left\{ \sin \beta_1 \sin \beta_2 + \cos \beta_1 \cos \beta_2 \cos [180 - (\alpha_1 + \alpha_2)] \right\}$$

$$X_2 = \cos^{-1} \left\{ \sin \beta_1 \sin \beta_3 + \cos \beta_1 \cos \beta_3 \cos [180 - (\alpha_3 + \alpha_1)] \right\}$$

Where:  $\alpha_1$  = as value, step 6.3.15.1.8

$\alpha_2$  = as value, step 6.3.15.1.13

$\alpha_3$  = as value, step 6.3.15.1.8

- 6.3.15.2 Computer Loading of Detent Calibration Data

- 6.3.15.2.1 On K-148 enter:

|         |         |                          |
|---------|---------|--------------------------|
| VERB 21 | NOUN 03 | ENTER                    |
| 01467   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent L AZ data) |
|         |         | ENTER                    |
| 01470   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent F AZ data) |
|         |         | ENTER                    |
| 01471   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent R AZ data) |
|         |         | ENTER                    |
| 01472   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent L EL data) |
|         |         | ENTER                    |
| 01473   |         | ENTER                    |
| XXX.XX  |         | ENTER (Detent F EL data) |
|         |         | ENTER                    |

- 6.3.15.2.1 (cont)
- 1474                      ENTER  
XXX.XX                    ENTER (Detent R EL data)
- 6.3.15.3 AOT Measurement of  $X_1$
- 6.3.15.3.1 On K-148 enter:
- VERB 57                    ENTER  
00012                    ENTER  
Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display.
- 6.3.15.3.2 On Computer Control and Reticle Dimming Assembly press MARK X pushbutton. Observe VERB 50 displayed on CRT DSKY display.
- 6.3.15.3.3 On DSKY press ENTER
- Observe VERB 21    NOUN 30 flashing on DSKY
- 6.3.15.3.4 On DSKY enter:
- 00000                    ENTER  
Observe VERB 21    NOUN 43 flashing  
00001                    ENTER  
Observe VERB 21    NOUN 42 flashing
- 6.3.15.3.5 Set AOT in I, detent position.
- 6.3.15.3.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record LY = XXX.XX.
- 6.3.15.3.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT Dial indication as LS XXX.XX.
- 6.3.15.3.8 On DSKY enter:
- \*XXX.XX                    ENTER (LY from 6.3.15.3.6)  
Observe VERB 22    NOUN 42 flashing  
\*XXX.XX                    ENTER (LS from 6.3.15.3.7)  
Observe VERB 51 flashing and R1 = 00002.
- 6.3.15.3.9 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed.
- 6.3.15.3.10 On DSKY press ENTER
- Observe VERB 21, NOUN 30 flashing on DSKY.

- 6.3.15.2.1 (cont)  
1474 ENTER  
XXX.XX ENTER (Detent R EL data)
- 6.3.15.3 AOT Measurement of  $I_1$
- 6.3.15.3.1 On K-148 enter:  
VERB 57 ENTER  
00012 ENTER  
Observe VERB 51 flashing and R1 = 00001 on CRT DSKY display.
- 6.3.15.3.2 On Computer Control and Reticle Dimming Assembly press MARK X pushbutton. Observe VERB 50 displayed on CRT DSKY display.
- 6.3.15.3.3 On DSKY press ENTER  
Observe VERB 21 NOUN 30 flashing on DSKY
- 6.3.15.3.4 On DSKY enter:  
00000 ENTER  
Observe VERB 21 NOUN 43 flashing  
00001 ENTER  
Observe VERB 21 NOUN 42 flashing
- 6.3.15.3.5 Set AOT in  $I_1$  detent position.
- 6.3.15.3.6 Rotate the AOT control knob clockwise until the center of the target reticle is superimposed between the double Y reticle. Read and record LY = XXX.XX.
- 6.3.15.3.7 Rotate the AOT control knob until the center of the target reticle is superimposed between the double SPIRAL lines of AOT reticle. Record AOT Dial indication as 18 XXX.XX.
- 6.3.15.3.8 On DSKY enter:  
\*XXX.XX ENTER (LY from 6.3.15.3.6)  
Observe VERB 22 NOUN 42 flashing  
\*XXX.XX ENTER (18 from 6.3.15.3.7)  
Observe VERB 51 flashing and R1 = 00002.
- 6.3.15.3.9 On Computer Control and Reticle Dimming Assembly, press MARK X pushbutton. Observe VERB 50 displayed.
- 6.3.15.3.10 On DSKY press ENTER  
Observe VERB 21, NOUN 30 flashing on DSKY.

6.3.15.3.11 On DEKY enter:

00000 ENTER  
Observe VERB 21, NOUN 43 flashing  
00002 ENTER  
Observe VERB 21, NOUN 42 flashing

6.3.15.3.12 Set AOT in F detent position.

6.3.15.4.7 On DEKY enter:

00000 ENTER  
Observe VERB 21 NOUN 43 flashing  
00002 ENTER  
Observe VERB 21 NOUN 42 flashing  
+XXX.XX ENTER (RY from 6.3.15.1.6)  
Observe VERB 22 NOUN 42 flashing  
+XXX.XX ENTER (RS from 6.3.15.1.7)  
Observe VERB 06 NOUN 03, R1 =  $X249.08$  degrees.

6.3.16 Flight Rope Fixed Memory Bank Sum Check

NOTE: Before proceeding with this test, obtain a Computer Program listing of the flight program being tested. Prepare a list of the bank CKSM bugger words.

6.3.16.1 Verify G&N system in Standby Mode.

6.3.16.2 On K-148 enter the following sequence:

Press ERR RST  
VERB 56 ENTER  
Observe VERB 06 NOUN 01 flashing.

6.3.16.3 Record the CRT DEKY display indications.

|               |                         |
|---------------|-------------------------|
| Row 1 = AAAAA | Bank Sum                |
| Row 2 = 000BB | Bank Number             |
| Row 3 = CCCCC | (Bank CKSM bugger word) |

Row 1 shall be the same as or the complement of the number displayed in Row 2. Row 3 Indication shall be the same as the bugger word recorded above for the bank tested.

6.3.16.4 On K-148 enter VERB 33 ENTER

6.3.16.5 Repeat paragraphs 6.3.16.3 and 6.3.16.4 until all memory bank sums have been checked.

6.3.16.6 On K-148 enter VERB 34 ENTER.

6.3.15.3.11 On DSKY enter:

00000            ENTER  
Observe VERB 21, NOUN 43 flashing  
00002            ENTER  
Observe VERB 21, NOUN 42 flashing

6.3.15.3.12 Set ACT in F detent position.

6.3.15.4.7 On DSKY enter:

00000            ENTER  
Observe VERB 21 NOUN 43 flashing  
00002            ENTER  
Observe VERB 21 NOUN 42 flashing  
+XXX.XX            ENTER (RY from 6.3.15.1.6)  
Observe VERB 22 NOUN 42 flashing  
+XXX.XX            ENTER (RS from 6.3.15.1.7)  
Observe VERB 06 NOUN 03, R1 = X2±0.08 degrees.

6.3.16 Flight Rope Fixed Memory Bank Sum Check

NOTE: Before proceeding with this test, obtain a Computer Program listing of the flight program being tested. Prepare a list of the bank CKSM bugger words.

6.3.16.1 Verify GAN system in Standby Mode.

6.3.16.2 On K-148 enter the following sequence:

Press ERR RST  
VERB 56            ENTER  
Observe VERB 06 NOUN 01 flashing.

6.3.16.3 Record the CRT DSKY display indications.

|               |                         |
|---------------|-------------------------|
| Row 1 = AAAAA | Bank Sum                |
| Row 2 = 000BB | Bank Number             |
| Row 3 = CCCCC | (Bank CKSM bugger word) |

Row 1 shall be the same as or the complement of the number displayed in Row 2. Row 3 Indication shall be the same as the bugger word recorded above for the bank tested.

6.3.16.4 On K-148 enter VERB 33 ENTER

6.3.16.5 Repeat paragraphs 6.3.16.3 and 6.3.16.4 until all memory bank sums have been checked.

6.3.16.6 On K-148 enter VERB 34 ENTER.

- 6.3.17. LGC Clock Alignment Test
- 6.3.17.1 Verify the following CRT indications:
- ACCEPT UPLINK - ON  
UP LOCK - OFF  
OP ERROR - OFF
- 6.3.17.2 Set R144 to 00001 and execute observe that CRT indicates TIME ERROR as blank.
- 6.3.17.3 Set 70 00024 020 into C156 to insert K-FACT Execute.
- 6.3.17.4 Set 71 00000 000 into C156 to insert TEPOCH. Execute.
- 6.3.17.5 Obtain Range Time in Hours, Minutes, and Seconds.
- 6.3.17.6 Add 5 minutes to Range time and insert 99 XX (HRS) XX (MIN's) XXX (SEC's) into C156. Execute
- 6.3.17.7 Set 91 + 00000 00 into C156 to insert AGC RESET time. Execute.
- 6.3.17.8 Before Range Time +5 minutes occurs, set 0001 into R152. Execute.
- 6.3.17.9 Verify that CRT indication of TIME ERROR is blank.
- NOTE: If TIME ERROR 1 is present, repeat all preceding steps of LGC Clock Alignment.
- 6.3.17.10 Set R152 to 0000. Execute.
- 6.3.17.11 Set R152 to 0010. Execute. Record CRT indication of DELTA TIME. Verify that CRT indication of TIME ERROR is blank.
- 6.3.17.12 Set R152 to 0000. Execute.
- 6.3.17.13 Set R152 to 0100. Execute. Verify that CRT indication of TIME ERROR is blank.
- 6.3.17.14 Set R152 to 0000. Execute.
- 6.3.17.15 Set R152 to 0010. Execute. Record CRT indication of DELTA TIME. DELTA TIME shall be 00(HRS), 00(MIN's) 000.000(SEC's)  $\pm 0.01$  SEC.
- 6.3.17.16 Set R152 to 0000. Execute.



- 6.3.17 LGC Clock Alignment Test
- 6.3.17.1 Verify the following CRT indications:
- ACCEPT UPLINK - ON  
UP LOCK - OFF  
OP ERROR - OFF
- 6.3.17.2 Set R144 to 00001 and execute observe that CRT indicates TIME ERROR as blank.
- 6.3.17.3 Set 70 00024 020 into C156 to insert K-FACT Execute.
- 6.3.17.4 Set 71 00000 000 into C156 to insert TKPOCH. Execute.
- 6.3.17.5 Obtain Range Time in Hours, Minutes, and Seconds.
- 6.3.17.6 Add 5 minutes to Range time and insert 99 XX (HRS) XX (MIN's) XXX (SEC's) into C156. Execute
- 6.3.17.7 Set 91 + 00000 00 into C156 to insert AGC RESET time. Execute.
- 6.3.17.8 Before Range Time +5 minutes occurs, set 0001 into R152. Execute.
- 6.3.17.9 Verify that CRT indication of TIME ERROR is blank.
- NOTE: If TIME ERROR 1 is present, repeat all preceding steps of LGC Clock Alignment.
- 6.3.17.10 Set R152 to 0000. Execute.
- 6.3.17.11 Set R152 to 0010. Execute. Record CRT indication of DELTA TIME. Verify that CRT indication of TIME ERROR is blank.
- 6.3.17.12 Set R152 to 0000. Execute.
- 6.3.17.13 Set R152 to 0100. Execute. Verify that CRT indication of TIME ERROR is blank.
- 6.3.17.14 Set R152 to 0000. Execute.
- 6.3.17.15 Set R152 to 0010. Execute. Record CRT indication of DELTA TIME. DELTA TIME shall be 00(HRS), 00(MIN's) 000.000(SEC's) ±0.01 SEC.
- 6.3.17.16 Set R152 to 0000. Execute.

## APPENDIX I

## MEASUREMENT TOLERANCES

| SIGNAL           | SIGNAL NAME                  | G&N LAB TEST REQUIREMENT                 | PSAAM AND/OR SCA UNCERTAINTY % OF FULL SCALE |
|------------------|------------------------------|------------------------------------------|----------------------------------------------|
| OG 1020 link 4*  | +14 vdc LGC Supply           | 14.0±0.2 vdc                             | 0%                                           |
| OG 1030 link 4   | +4 vdc LGC Supply            | 4.0±0.15 vdc                             | 0%                                           |
| OG 1040 link 5** | +120 vdc FIPA Supply         | 120±6.0 vdc                              | 1%                                           |
| OG 1070 link 4   | +4 vdc CDU Supply            | 4.0±0.2 vdc                              | 0%                                           |
| OG 1100 link 4   | -28 vdc Supply               | -27.5±6.0 vdc                            | 0%                                           |
| OG 1110 link 5   | 2.5 vdc Telemetry Bias No. 1 | 2.5±0.1 vdc                              | 0%                                           |
| OG 1201 link 5   | IMU 28V 800 cps 1%           | 28±0.56V rms                             | 1%                                           |
| OG 1202 link 4   | IMU 28V 800 cps 5%           | 28±1.4V rms                              | 1.5%                                         |
| OG 1203 link 4   | IMU 28V 800 cps 5%           | 28±1.1V rms                              | 1.5%                                         |
| OG 1331 link 5   | 3.2 kc 28V Supply 1%         | 28.6±0.56V rms                           | 1%                                           |
| OG 1500 link 4   | +28 vdc IMU Oper BUS         | 28.0-3.5, +5.5 vdc                       | 0%                                           |
| OG 1510 link 4   | +28 vdc IMU STBY BUS         | 28.0-3.5, +5.5 vdc                       | 0%                                           |
| OG 1513X link 4  | +28 vdc IMU STBY/OFF         | 28.0±1 vdc                               | 0%                                           |
| OG 1520 link 4   | +28 vdc LGC Oper BUS         | 28.0 + 4.5, -3.5 vdc                     | 0%                                           |
| OG 1523X link 5  | +28 vdc LGC Operate          | 28.0±1 vdc                               | 0%                                           |
| OG 2001 link 5   | X FIPA S.G. OUT IN PH        | +2.5±0.128V rms at 1g                    | 3%                                           |
| OG 2021 link 5   | Y FIPA S.G. OUT IN PH        | +2.5±0.128V rms at 1g                    | 3%                                           |
| OG 2041 link 5   | Z FIPA S.G. OUT IN PH        | +2.5±0.128V rms at 1g                    | 3%                                           |
| OG 2106 link 4   | IG Servo Error Total         | 0.0±60 MV rms at null                    | 1%                                           |
| OG 2107 link 5   | IG Servo Error IN PH         | 0.0±60 MV rms at null                    | 2%                                           |
| OG 2110 link 4   | IG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 0%                                           |
| OG 2110 link 5   | IG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 1%                                           |
| OG 2112 link 5   | IG 1X Resolver Out-Sine      | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| OG 2113 link 5   | IG 1X Resolver Out-Cosine    | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| OG 2121 link 5   | IG 1X Resolver Out-Sine 11°  | 5.35±0.27V rms at 11°                    | 2%                                           |
| OG 2136 link 4   | MG Servo Error Total         | 0.0±60 MV rms at null                    | 1%                                           |
| OG 2137 link 5   | MG Servo Error IN PH         | 0.0±60 MV rms at null                    | 2%                                           |
| OG 2140 link 4   | MG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 0%                                           |
| OG 2140 link 5   | MG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 1%                                           |
| OG 2142 link 5   | MG 1X Resolver Out-Sine      | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| OG 2143 link 5   | MG 1X Resolver Out-Cosine    | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| OG 2151 link 5   | MG 1X Resolver Out-Sine 11°  | 5.35±0.27V rms at 11°                    | 2%                                           |
| OG 2166 link 4   | OG Servo Error Total         | 0.0±60 MV rms at null                    | 1%                                           |
| OG 2167 link 5   | OG Servo Error IN PH         | 0.0±60 MV rms at null                    | 2%                                           |
| OG 2170 link 4   | OG Torque Motor Current      | 0.9 AMP Max during any fine Align Torque | 0%                                           |
| OG 2170 link 5   | OG Torque Motor Current      | 0.9 AMP Max during any fine Align Torque | 1%                                           |
| OG 2172 link 5   | OG 1X Resolver Out-Sine      | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| OG 2173 link 5   | OG 1X Resolver Out-Cosine    | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| OG 2181 link 5   | OG 1X Resolver Out-Sine 11°  | 5.35±0.27V rms at 11°                    | 2%                                           |
| OG 2219 link 5   | Pitch Attitude Error         | 5.05±0.5V rms at 17°                     | 1%                                           |
| OG 2220 link 4   | IG CDU Fine Error            | 0.0±0.7V rms at null                     | 1%                                           |
| OG 2221 link 4   | IG CDU Coarse Error          | 0.0±0.68V rms at null                    | 1%                                           |

APPENDIX I  
MEASUREMENT TOLERANCES

| SIGNAL           | SIGNAL NAME                  | G&N LAB TEST REQUIREMENT                 | PSAAM AND/OR SCA UNCERTAINTY % OF FULL SCALE |
|------------------|------------------------------|------------------------------------------|----------------------------------------------|
| GG 1020 link 4*  | +14 vdc LGC Supply           | 14.0±0.2 vdc                             | 0%                                           |
| GG 1030 link 4   | +4 vdc LGC Supply            | 4.0±0.15 vdc                             | 0%                                           |
| GG 1040 link 5** | +120 vdc PIPA Supply         | 120±6.0 vdc                              | 1%                                           |
| GG 1070 link 4   | +4 vdc CDU Supply            | 4.0±0.2 vdc                              | 0%                                           |
| GG 1100 link 4   | -28 vdc Supply               | -27.5±6.0 vdc                            | 0%                                           |
| GG 1110 link 5   | 2.5 vdc Telemetry Bias No. 1 | 2.5±0.1 vdc                              | 0%                                           |
| GG 1201 link 5   | IMU 28V 800 cps 1%           | 28±0.56V rms                             | 1%                                           |
| GG 1202 link 4   | IMU 28V 800 cps 5%           | 28±1.4V rms                              | 1.5%                                         |
| GG 1203 link 4   | IMU 28V 800 cps 5%           | 28±2.1V rms                              | 1.5%                                         |
| GG 1331 link 5   | 3.2 kc 28V Supply 1%         | 28.6±0.56V rms                           | 1%                                           |
| GG 1500 link 4   | +28 vdc IMU Oper BUS         | 28.0-3.5, +5.5 vdc                       | 0%                                           |
| GG 1510 link 4   | +28 vdc IMU STBY BUS         | 28.0-3.5, +5.5 vdc                       | 0%                                           |
| GG 1513X link 5  | +28 vdc IMU STBY/OFF         | 28.0±1 vdc                               | 0%                                           |
| GG 1520 link 4   | +28 vdc LGC Oper BUS         | 28.0 + 4.5, -3.5 vdc                     | 0%                                           |
| GG 1523X link 5  | +28 vdc LGC Operate          | 28.0±1 vdc                               | 0%                                           |
| GG 2001 link 5   | X PIPA S.G. OUT IN PH        | +2.5±0.128V rms at 1g                    | 3%                                           |
| GG 2021 link 5   | Y PIPA S.G. OUT IN PH        | +2.5±0.128V rms at 1g                    | 3%                                           |
| GG 2041 link 5   | Z PIPA S.G. OUT IN PH        | +2.5±0.128V rms at 1g                    | 3%                                           |
| GG 2106 link 4   | IG Servo Error Total         | 0.0±60 MV rms at null                    | 1%                                           |
| GG 2107 link 5   | IG Servo Error IN PH         | 0.0±60 MV rms at null                    | 2%                                           |
| GG 2110 link 4   | IG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 0%                                           |
| GG 2110 link 5   | IG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 1%                                           |
| GG 2112 link 5   | IG 1X Resolver Out-Sine      | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2113 link 5   | IG 1X Resolver Out-Cosine    | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2121 link 5   | IG 1X Resolver Out-Sine 11°  | 5.35±0.27V rms at 11°                    | 2%                                           |
| GG 2136 link 4   | MG Servo Error Total         | 0.0±60 MV rms at null                    | 1%                                           |
| GG 2137 link 5   | MG Servo Error IN PH         | 0.0±60 MV rms at null                    | 2%                                           |
| GG 2140 link 4   | MG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 0%                                           |
| GG 2140 link 5   | MG Torque Motor Current      | 0.5 AMP Max during any fine Align Torque | 1%                                           |
| GG 2142 link 5   | MG 1X Resolver Out-Sine      | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2143 link 5   | MG 1X Resolver Out-Cosine    | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2151 link 5   | MG 1X Resolver Out-Sine 11°  | 5.35±0.27V rms at 11°                    | 2%                                           |
| GG 2166 link 4   | OG Servo Error Total         | 0.0±60 MV rms at null                    | 1%                                           |
| GG 2167 link 5   | OG Servo Error IN PH         | 0.0±60 MV rms at null                    | 2%                                           |
| GG 2170 link 4   | OG Torque Motor Current      | 0.9 AMP Max during any fine Align Torque | 0%                                           |
| GG 2170 link 5   | OG Torque Motor Current      | 0.9 AMP Max during any fine Align Torque | 1%                                           |
| GG 2172 link 5   | OG 1X Resolver Out-Sine      | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2173 link 5   | OG 1X Resolver Out-Cosine    | 19.65±0.98V rms at 45°                   | 2.5%                                         |
| GG 2181 link 5   | OG 1X Resolver Out-Sine 11°  | 5.35±0.27V rms at 11°                    | 2%                                           |
| GG 2219 link 5   | Pitch Attitude Error         | 5.05±0.5V rms at 17°                     | 1%                                           |
| GG 2220 link 4   | IG CDU Fine Error            | 0.0±0.7V rms at null                     | 1%                                           |
| GG 2221 link 4   | IG CDU Coarse Error          | 0.0±0.68V rms at null                    | 1%                                           |

## APPENDIX I (Continued)

| SIGNAL         | SIGNAL NAME                         | G&N LAB TEST<br>REQUIREMENT | PSAAM AND/OR<br>SCA UNCERTAINTY %<br>OF FULL SCALE |
|----------------|-------------------------------------|-----------------------------|----------------------------------------------------|
| GG 2249 link 5 | YAW Attitude Error                  | 0.05±0.5V rms at 17°        | 1%                                                 |
| GG 2250 link 4 | MG CDU Fine Error                   | 0.5±0.07V rms at null       | 1%                                                 |
| GG 2251 link 4 | MG CDU Coarse Error                 | 0.0±0.68V rms at null       | 1%                                                 |
| GG 2279 link 5 | Roll Attitude Error                 | 5.05±0.5V rms at null       | 1%                                                 |
| GG 2280 link 4 | OG CDU Fine Error                   | 0.0±0.07V rms at null       | 1%                                                 |
| GG 2281 link 4 | OG CDU Coarse Error                 | 0.0±0.68V rms at null       | 1%                                                 |
| GG 2300 link 5 | PIPA Temperature                    | 130.5 ± 1.5°F in Operate    | 1%                                                 |
| GG 2301 link 4 | IRIG Temperature                    | 135 ± 2.5°F in Operate      | 1%                                                 |
| GG 2301 link 5 | IRIG Temperature                    | 135 ± 2.5°F in Operate      | 1%                                                 |
| GG 2302 link 4 | IMU Heater Current On               | 28±1 vdc                    | 0%                                                 |
| GG 2303 link 4 | IMU Blower Current On               | 28±1 vdc                    | 0%                                                 |
| GG 3304 link 5 | RR Shaft 1X Resolver Out-Sine       | 19.65±0.98V rms at 45°      | 2.5%                                               |
| GG 3305 link 5 | RR Shaft 1X Resolver Out-Cosine     | 19.65±0.98V rms at 45°      | 2.5%                                               |
| GG 3311 link 4 | RR Shaft CDU Fine Error             | 0.0±0.07V rms at null       | 1%                                                 |
| GG 3312 link 4 | RR Shaft CDU Coarse Error           | 0.0±0.68V rms at null       | 1%                                                 |
| GG 3321 link 4 | RR Trunnion CDU Fine Error          | 0.0±0.07V rms at null       | 1%                                                 |
| GG 3322 link 4 | RR Trunnion CDU Coarse Error        | 0.0±0.68V rms at null       | 1%                                                 |
| GG 3324 link 5 | RR Trunnion 1X Resolver Out-Sine    | 19.65±0.98V rms at 45°      | 2.5%                                               |
| GG 3325 link 5 | RR Trunnion 1X Resolver Out-Cosine  | 19.65±0.98V rms at 45°      | 2.5%                                               |
| GG 4300 link 4 | LGC Temperature                     | 87.5±2.5°F                  | 0%                                                 |
| GG 6020 link 4 | PIPA Calibration Module Temperature | 67.5±22.5°F                 | 0%                                                 |
| GG 6020 link 5 | PIPA Calibration Module Temperature | 67.5±22.5°F                 | 0%                                                 |
| GG 6021 link 4 | PSA Temperature                     | 85±25.0°F                   | 0%                                                 |

\* Link 4 - PSAAM Output Signal  
 \*\* Link 5 - SCA Output Signal

## APPENDIX I (Continued)

| SIGNAL         | SIGNAL NAME                         | G&N LAB TEST REQUIREMENT | PSAAM AND/OR SCA UNCERTAINTY % OF FULL SCALE |
|----------------|-------------------------------------|--------------------------|----------------------------------------------|
| OG 2249 link 5 | YAW Attitude Error                  | 0.05±0.5V rms at 17°     | 1%                                           |
| OG 2250 link 4 | MG CDU Fine Error                   | 0.5±0.07V rms at null    | 1%                                           |
| OG 2251 link 4 | MG CDU Coarse Error                 | 0.0±0.68V rms at null    | 1%                                           |
| OG 2279 link 5 | Roll Attitude Error                 | 5.05±0.5V rms at null    | 1%                                           |
| OG 2280 link 4 | OG CDU Fine Error                   | 0.0±0.07V rms at null    | 1%                                           |
| OG 2281 link 4 | OG CDU Coarse Error                 | 0.0±0.68V rms at null    | 1%                                           |
| OG 2300 link 5 | PIPA Temperature                    | 130.5 ± 1.5°F in Operate | 1%                                           |
| OG 2301 link 4 | IRIG Temperature                    | 135 ± 2.5°F in Operate   | 1%                                           |
| OG 2301 link 5 | IRIG Temperature                    | 135 ± 2.5°F in Operate   | 1%                                           |
| OG 2302 link 4 | IMU Heater Current On               | 28±1 vdc                 | 0%                                           |
| OG 2303 link 4 | IMU Blower Current On               | 28±1 vdc                 | 0%                                           |
| OG 3304 link 5 | RR Shaft 1X Resolver Out-Sine       | 19.65±0.98V rms at 45°   | 2.5%                                         |
| OG 3305 link 5 | RR Shaft 1X Resolver Out-Cosine     | 19.65±0.98V rms at 45°   | 2.5%                                         |
| OG 3311 link 4 | RR Shaft CDU Fine Error             | 0.0±0.07V rms at null    | 1%                                           |
| OG 3312 link 4 | RR Shaft CDU Coarse Error           | 0.0±0.68V rms at null    | 1%                                           |
| OG 3321 link 4 | RR Trunnion CDU Fine Error          | 0.0±0.07V rms at null    | 1%                                           |
| OG 3322 link 4 | RR Trunnion CDU Coarse Error        | 0.0±0.68V rms at null    | 1%                                           |
| OG 3324 link 5 | RR Trunnion 1X Resolver Out-Sine    | 19.65±0.98V rms at 45°   | 2.5%                                         |
| OG 3325 link 5 | RR Trunnion 1X Resolver Out-Cosine  | 19.65±0.98V rms at 45°   | 2.5%                                         |
| OG 4300 link 4 | LGC Temperature                     | 87.5±2.5°F               | 0%                                           |
| OG 6020 link 4 | PIPA Calibration Module Temperature | 67.5±22.5°F              | 0%                                           |
| OG 6020 link 5 | PIPA Calibration Module Temperature | 67.5±22.5°F              | 0%                                           |
| OG 6021 link 4 | PSA Temperature                     | 85±25.0°F                | 0%                                           |

\* Link 4 - PSAAM Output Signal  
 \*\* Link 5 - SCA Output Signal

ADDENDUM I

LEM 1

ADDITION 1: The following procedure will be performed for LEM 1 only.

6.3.18 Gyrocompassing Test

6.3.18.1 Inertial Instrument Calibration data Load.

6.3.18.1.1 On K-148 enter:

|         |               |       |
|---------|---------------|-------|
| VERB 21 | NOUN 01       | ENTER |
| 01436   |               | ENTER |
| XXXXX   | (X PIPA BIAS) | ENTER |
| 01437   |               | ENTER |
| XXXXX   | (X PIPA S.F.) | ENTER |
| 01440   |               | ENTER |
| XXXXX   | (Y PIPA BIAS) | ENTER |
| 01441   |               | ENTER |
| XXXXX   | (Y PIPA S.F.) | ENTER |
| 01442   |               | ENTER |
| XXXXX   | (Z PIPA BIAS) | ENTER |
| 01443   |               | ENTER |
| XXXXX   | (Z PIPA S.F.) | ENTER |
| 01444   |               | ENTER |
| XXXXX   | (MBDX)        | ENTER |
| 01445   |               | ENTER |
| XXXXX   | (MBDY)        | ENTER |
| 01446   |               | ENTER |
| XXXXX   | (MBDE)        | ENTER |
| 01447   |               | ENTER |
| XXXXX   | (ADIAK)       | ENTER |
| 01450   |               | ENTER |
| XXXXX   | (ADIAK)       | ENTER |
| 01451   |               | ENTER |
| XXXXX   | (ADIZ)        | ENTER |
| 01452   |               | ENTER |
| XXXXX   | (ADSRAX)      | ENTER |

6.3.18.1.1 (cont)

|       |          |       |
|-------|----------|-------|
| 01453 |          | ENTER |
| XXXXX | (ADSRAY) | ENTER |
| 01454 |          | ENTER |
| XXXXX | (ADSRAY) | ENTER |

6.3.18.2 Non-Standard Gyrocompassing Position Vector Load.

6.3.18.2.1 On K-148 enter:

|         |         |       |
|---------|---------|-------|
| VERB 21 | MOON 01 | ENTER |
| 02721   |         | ENTER |
| 15666   |         | ENTER |
|         |         | ENTER |
| 02722   |         | ENTER |
| 10512   |         | ENTER |
|         |         | ENTER |
| 02723   |         | ENTER |
| 75424   |         | ENTER |
|         |         | ENTER |
| 02724   |         | ENTER |
| 71207   |         | ENTER |
|         |         | ENTER |
| 02725   |         | ENTER |
| 70305   |         | ENTER |
|         |         | ENTER |
| 02726   |         | ENTER |
| 47414   |         | ENTER |
|         |         | ENTER |
| 02727   |         | ENTER |
| 10000   |         | ENTER |
|         |         | ENTER |
| 02730   |         | ENTER |
| 00000   |         | ENTER |
|         |         | ENTER |
| 02731   |         | ENTER |
| 04205   |         | ENTER |
|         |         | ENTER |
| 02732   |         | ENTER |
| 16131   |         | ENTER |
|         |         | ENTER |
| 02733   |         | ENTER |
| 15137   |         | ENTER |
|         |         | ENTER |
| 02734   |         | ENTER |
| 02466   |         | ENTER |
|         |         | ENTER |
| 02735   |         | ENTER |
| 00000   |         | ENTER |
|         |         | ENTER |
| 02736   |         | ENTER |
| 00000   |         | ENTER |
|         |         | ENTER |
| 02737   |         | ENTER |
| 17163   |         | ENTER |
|         |         | ENTER |

6.3.18.1.1 (cont)

|       |          |      |
|-------|----------|------|
| 01453 |          | ENTR |
| XXXXX | (ADSRAX) | ENTR |
| 01454 |          | ENTR |
| XXXXX | (ADSRAX) | ENTR |

6.3.18.2 Non-Standard Gyrocompassing Position Vector Load.

6.3.18.2.1 On K-148 enter:

|         |         |      |
|---------|---------|------|
| VERB 21 | MOON 01 | ENTR |
| 02721   |         | ENTR |
| 15666   |         | ENTR |
|         |         | ENTR |
| 02722   |         | ENTR |
| 10512   |         | ENTR |
|         |         | ENTR |
| 02723   |         | ENTR |
| 75424   |         | ENTR |
|         |         | ENTR |
| 02724   |         | ENTR |
| 71207   |         | ENTR |
|         |         | ENTR |
| 02725   |         | ENTR |
| 70305   |         | ENTR |
|         |         | ENTR |
| 02726   |         | ENTR |
| 47414   |         | ENTR |
|         |         | ENTR |
| 02727   |         | ENTR |
| 10000   |         | ENTR |
|         |         | ENTR |
| 02730   |         | ENTR |
| 00000   |         | ENTR |
|         |         | ENTR |
| 02731   |         | ENTR |
| 04205   |         | ENTR |
|         |         | ENTR |
| 02732   |         | ENTR |
| 16131   |         | ENTR |
|         |         | ENTR |
| 02733   |         | ENTR |
| 15137   |         | ENTR |
|         |         | ENTR |
| 02734   |         | ENTR |
| 02466   |         | ENTR |
|         |         | ENTR |
| 02735   |         | ENTR |
| 00000   |         | ENTR |
|         |         | ENTR |
| 02736   |         | ENTR |
| 00000   |         | ENTR |
|         |         | ENTR |
| 02737   |         | ENTR |
| 17163   |         | ENTR |
|         |         | ENTR |



6.3.18.2.1 (cont)

|       |       |
|-------|-------|
| 02740 | ENTER |
| 20747 | ENTER |
| 02741 | ENTER |
| 04726 | ENTER |
| 02742 | ENTER |
| 15360 | ENTER |

6.3.18.3 Gyrocompassing

6.3.18.3.1 On K-148 enter

|         |       |
|---------|-------|
| VERB 57 | ENTER |
| 00007   | ENTER |

6.3.18.3.2 VERB 06 NOUN 51 shall flash

6.3.18.3.3 The CRT DSKY shall display Nav Base Azimuth in Row 1 and site latitude in Row 2.

6.3.18.3.4 If the display in Row 1 and Row 2 is correct proceed to the next step. If value for Row 1 or Row 2 is incorrect enter the following into K-148.

|         |       |                          |
|---------|-------|--------------------------|
| VERB 21 | ENTER |                          |
| +XXXXX  | ENTER | Correct Nav Base Azimuth |
| VERB 22 | ENTER |                          |
| +28.516 | ENTER |                          |

6.3.18.3.5 In K-148 enter:

|         |       |
|---------|-------|
| VERB 33 | ENTER |
|---------|-------|

6.3.18.3.6 VERB 06 NOUN 66 shall flash.

6.3.18.3.7 The CRT DSKY shall display +00120 in Row 1 and Row 3 shall display +00011. If the display is correct proceed to the next step. If the display is incorrect enter the following into K-148:

|         |       |
|---------|-------|
| VERB 21 | ENTER |
| +00120  | ENTER |
| VERB 23 | ENTER |
| +00011  | ENTER |

6.3.18.3.8 On K-148 enter:

|                 |       |
|-----------------|-------|
| VERB 33         | ENTER |
| VERB 16 NOUN 20 | ENTER |

6.3.18.2.1 (cont)

|       |       |
|-------|-------|
| 02740 | ENTER |
| 20747 | ENTER |
| 02741 | ENTER |
| 04726 | ENTER |
| 02742 | ENTER |
| 15360 | ENTER |

6.3.18.3 Gyrocompassing

6.3.18.3.1 On K-148 enter

|         |       |
|---------|-------|
| VERB 57 | ENTER |
| 00007   | ENTER |

6.3.18.3.2 VERB 06 NOUN 51 shall flash

6.3.18.3.3 The CRT DSKY shall display Nav Base Azimuth in Row 1 and site latitude in Row 2.

6.3.18.3.4 If the display in Row 1 and Row 2 is correct proceed to the next step. If value for Row 1 a Row 2 is incorrect enter the following into K-148.

|         |       |                          |
|---------|-------|--------------------------|
| VERB 21 | ENTER |                          |
| +XXXXX  | ENTER | Correct Nav Base Azimuth |
| VERB 22 | ENTER |                          |
| +28.516 | ENTER |                          |

6.3.18.3.5 In K-148 enter:

|         |       |
|---------|-------|
| VERB 33 | ENTER |
|---------|-------|

6.3.18.3.6 VERB 06 NOUN 66 shall flash.

6.3.18.3.7 The CRT DSKY shall display +00120 in Row 1 and Row 3 shall display +00011. If the display is correct proceed to the next step. If the display is incorrect enter the following into K-148:

|         |       |
|---------|-------|
| VERB 21 | ENTER |
| +00120  | ENTER |
| VERB 23 | ENTER |
| +00011  | ENTER |

6.3.18.3.8 On K-148 enter:

|                 |       |
|-----------------|-------|
| VERB 33         | ENTER |
| VERB 16 NOUN 20 | ENTER |

- 6.3.18.3.9 One hour after step 6.3.18.3.8 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.
- 6.3.18.3.10 The Row 1 indication shall be within  $\pm$  To be supplied at a later date of desired launch azimuth.
- 6.3.18.3.11 The Row 2 and Row 3 indications shall To be supplied at a later date.
- 6.3.18.3.12 Two hours after performing paragraph 6.3.18.3.8 record CRT DSKY display of Row 1, Row 2, and Row 3.
- 6.3.18.3.13 The CRT DSKY display of Row 1 shall be within  $\pm$  degrees of the value recorded in 6.3.18.3.9. The CRT DSKY display of Row 2 and Row 3 shall be within  $\pm$  degrees of the respective values recorded in 6.3.18.3.4.
- 6.3.18.3.14 On K-148 enter the following:

|         |         |      |
|---------|---------|------|
| VERB 36 |         | ENTR |
| VERB 40 | NOUW 20 | ENTR |
| +00000  |         | ENTR |
| +00000  |         | ENTR |
| +00000  |         | ENTR |

- 6.3.18.3.9 One hour after step 6.3.18.3.8 has been performed, read and record CRT DSKY display of Row 1, Row 2, and Row 3.
- 6.3.18.3.10 The Row 1 indication shall be within ±To be supplied at a later date of desired launch azimuth.
- 6.3.18.3.11 The Row 2 and Row 3 indications shall ±To be supplied at a later date.
- 6.3.18.3.12 Two hours after performing paragraph 6.3.18.3.8 record CRT DSKY display of Row 1, Row 2, and Row 3.
- 6.3.18.3.13 The CRT DSKY display of Row 1 shall be within ± degrees of the value recorded in 6.3.18.3.9. The CRT DSKY display of Row 2 and Row 3 shall be within ± degrees of the respective values recorded in 6.3.18.3.4.
- 6.3.18.3.14 On K-448 enter the following:

|         |         |       |
|---------|---------|-------|
| VERB 36 |         | ENTER |
| VERB 40 | NOUW 20 | ENTER |
| +00000  |         | ENTER |
| +00000  |         | ENTER |
| +00000  |         | ENTER |

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APOLLO G&N Specification  
MD 1002349

ADDENDUM 1

LEM 1

Addition 2: Perform LEM 1 test in accordance with the Following Flowgram.

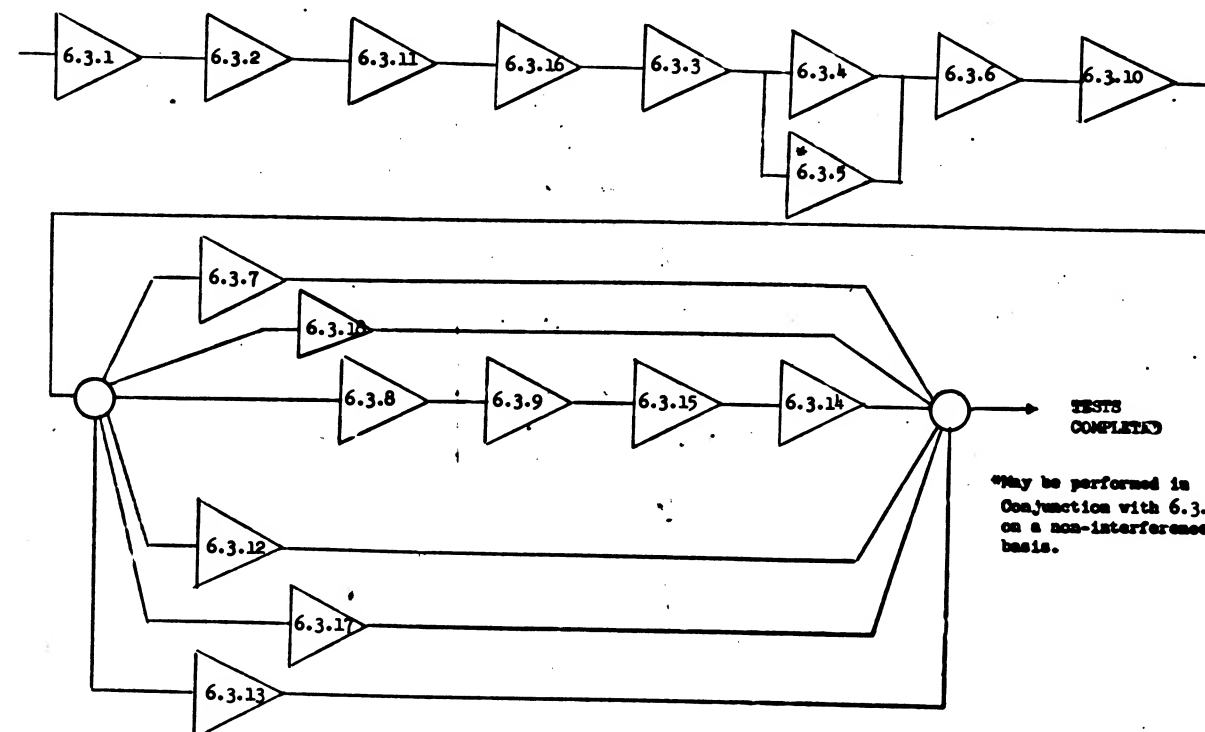
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MD 1002349

ADDENDUM 1

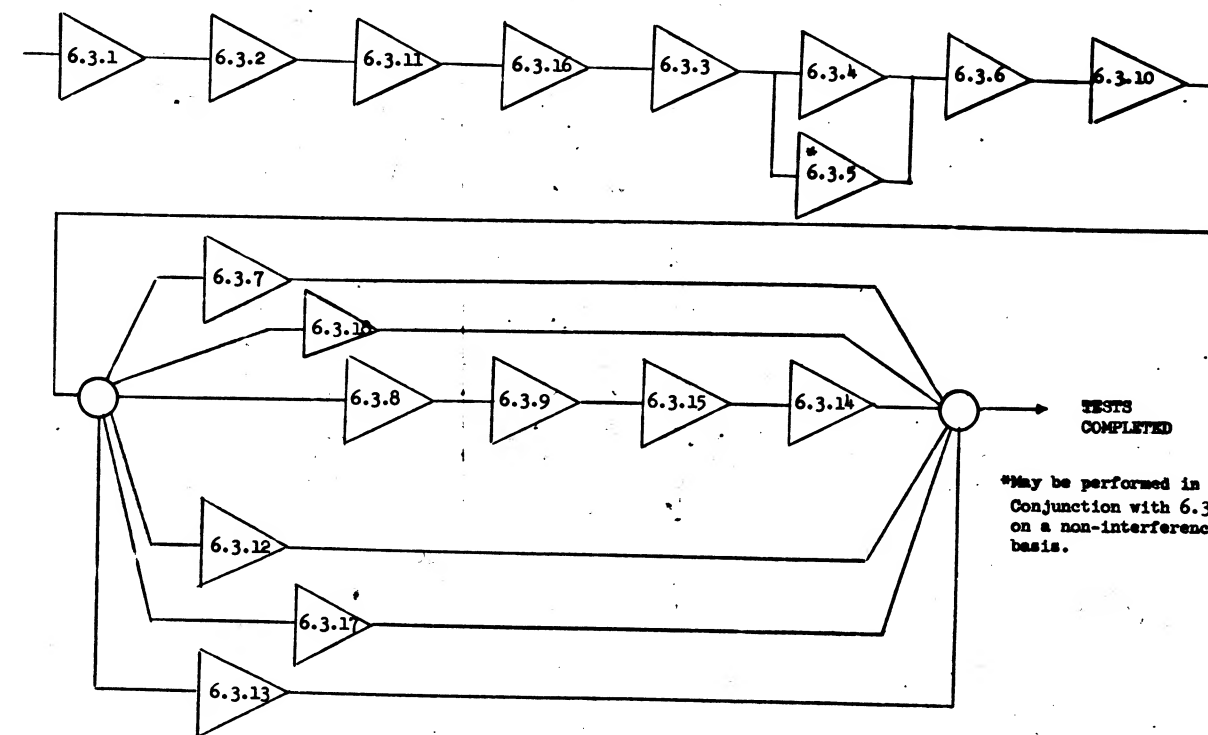
LEM 1

Addition 2: Perform LEM 1 test in accordance with the following Flowgram.



TEST PROCEDURE FLOWGRAM

FIGURE 1



TEST PROCEDURE FLOWGRAM

FIGURE 1